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APRIL 18, 1955

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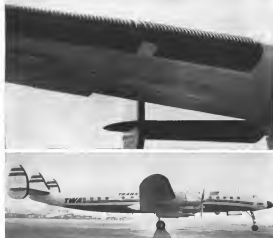
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RESEARCH KEYS **B.F. Goodrich** FIRST IN RUBBER



## New De-Icers improve airflow on TWA "Super-G" Connies

THE wings on TWA's new, luxurious Lockheed "Super G" Constellations have the most efficient ice protection yet developed—new B. F. Goodrich exclusive De-Icers.

Top photograph shows the basic design change. Notice how the small rubber tubes that inflate to sweep off ice are built close to, in line with the air stream.

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**B.F. Goodrich**  
FIRST IN RUBBER





## Domestic

Flight tests on the North American F100 as a supersonic speed engine not previously increased will be made by personnel of the Conquest Aircraft Company, Inc., later this spring. Aim of the 185-hour program: complete flight demonstration of longitudinal and lateral stability derivatives at Mach numbers where these data are not in existence.

UHF helicopter, Bell Aircraft Corp.'s test vehicle for evaluating new power control-wing aircraft, was accepted by the Air Force and started through final trials at the builder's Fort Worth plant. Equipped with a Turbo-prop engine, the helicopter is a joint USAF-Army development project.

Five American World Airways will start daily flights June 1 from Chicago and Detroit to Europe, the first daily international air service out of the two cities. PAA now operates three flights a week from the Midwest gateway, with step-lifts up to five Apr. 24 and in seven June 1.

Long-range radar air traffic control station opening in the New York metropolitan area last week (AV Feb. 14, p. 107). For the first time, Civil Aeronautics Administration and USAF will team up to build the new and for conducting the flow of aircraft to the area's airports. By May 1, radar will begin to replace the present method of peering and handling flights.

Continental Air Lines will send top executive group, headed by president Robert F. Sox, to England and Europe next month to confer with transport and engine builders on CAL's future needs. To be visited during the three-week tour: Boeing's Walkers-Aeroburg and Rolls-Royce and Fokker Royal Netherlands Aircraft Factories in Holland.

Longest operational runway in the U.S., completed at Albuquerque's Maxwells Airport, is shared jointly by commercial airlines and Kirtland AFB. The 13,775-ft runway, rebuilt at a cost of \$2.5 million, is expected to handle only by the 15,000-lb. testing step at Edwards AFB.

Heavy lifting jobs paid at Cleveland, USAF's big control facility, will begin production May 5. Operated by Aluminex Company of America, the \$40-million installation houses 20,000 and 35,000-lb. lifting pieces.



## C-130A Takes Off Quickly on First Flight

USAF's first production C-130A lifts off the runway after a brief run of 800 ft at Dallas AFB, Tex., near Lockheed Aircraft Corp.'s Marietta plant. The 54-ton turboprop-powered Douglas was airborne on the first light eight seconds after the brakes were released and had climbed to 2,000 ft, by the time it passed over the end of Dallas' 10,000-ft. runway. The C-130A is powered by four Allison T56s.

Fifteen P2V-7s assigned to NAS Jacksonville, Fla., are the first Lockheed Aircraft Corp.'s latest version of the Neptune amphibious patrol bomber to go on squadron service. Delivery followed preliminary evaluation tests at Patuxent River, Md.

185 turboprop deliveries by Cessna-Wright Corp. new 1800 series first 5,000.

Boeing Airplane Co. offered a 2.75% wage increase to its nearly 6,000 engineering employees in Seattle and Wichita. The raise would be retroactive to Oct. 1 and include higher overtime pay plus a retirement plan.

New data-processing systems will be developed by Minneapolis-Honeywell Regulator Co. and Raytheon Manufacturing Co. To engineer and market the high-speed electronics projects, the two companies have formed Datastrac Corp. at Wilbur, Mass. Honeywell will own 60% of the new firm, Raytheon 40%.

General Division of General Dynamics Corp. set Model 140 transports in Saudi Arabia. Deliveries will start deliveries May 26 and complete them June 17. Total value of the order, including spares, \$6 million. The planes will be taken from the production line of C-119s ordered by the Air Force postponing final delivery of USAF's contract until next year.

Los Angeles Airways formed a passenger traffic department to handle the helicopter airline's expanded activities.

Lockheed Aircraft Corp. delivered its 4,000th jet engine to the armed forces. The company now 28.5-million units.

hours and \$115 million in annual rent into the building the 4,000 T-33s, RT-33s and TV-3s.

Military Air Transport Services won the Doolittle Trophy for the lowest aircraft accident rate in the Air Force. Overall record for MATS: seven accidents per 100,000 flying hours.

Tucson Aircraft Corp. signed a new contract with Lockheed Aircraft Corp. that will extend production of P2V water wing aircraft at the Dallas plant through 1955.

## International

Civil Air Transport transferred substantially all its assets, liabilities and contracts to Aerco, Aeromarine Co., a subsidiary formed by the airline under National Civilian's company law. Despite the paper transaction, the company will continue to operate as CAT.

CF-105 production stretched may force A.V. Roe Canada to cut assembly line hours at its subsidiary company, Avco Aircraft, Ltd., and Canada Aerospace, Ltd. Probable layoffs 1,000 within each firm.

Gkanagae Helicopters, Ltd., purchased Canadian Helicopters, Ltd., and its subsidiary, Stuart Aviation, Ltd. The great Gkanagae base is Canada's east and west coast and receives its fleet to eight Sikorsky S-55s and 22 Bell 47s.

The 200th Freighter built by Bristol Airplane Co. was delivered to British Air Canada, Ltd. ON the 380 all-weather transport sold in the 90s was purchased by operators in 16 countries overseas.



## WORLD'S MOST REVOLUTIONARY ASSEMBLY LINE?



This is Asaph's new machine developed by General Mills for assembling electronic circuits automatically. It assembles these printed circuits, complete with a variety of electronic components, at the rate of 20 a minute. That's 8,000 completed assemblies in an 8-hour day! And Asaph's is accurate—close to zero "inspecting" and delivers none but perfect, usable assemblies.

Asaph's first assignment is defense work. It's helping DOD build huge air defense computers for the Air Force Station and at least one. But other orders will soon be available for assembling printed circuits used in radars, television sets and other electronic products.

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- ☐ radio-controlled navigation
- ☐ instrumentation (radio and wire)
- ☐ fire-control technology ☐ autonomous and high-altitude research

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## Washington Roundup

### Three Profit Probes

Three committees of Congress—each with a different approach—are proceeding with delicate profit inquiries likely to put the aircraft industry and other military contractors in the public spotlight before the end of the session.

These are:

• **House Armed Services Investigative subcommittee**, headed by Rep. Edward Brooke, has already launched an investigation of profits at aircraft prime contractors. Studies of the contracts of six companies—quadruply divided between production and research and development—are under way. Hearings are contemplated in May. This group's approach is on an individual contract basis, according to John Courtney, counsel.

The aircraft industry has been selected for first attention because it represents the largest segment of defense contracting. Courtney said that the subcommittee may later focus attention on electronics and other defense firms.

• **House Appropriations Committee** will announce an investigation of Defense Department procurement policies after the fiscal 1956 defense budget is brought up for action on the House floor early in May.

Members of the committee believe that high percentages of firms with defense business across the government is getting poor bargains in contracting.

"It put it very bluntly, we want to find out why the government is getting cheated," Rep. George Mahon, chairman of the Appropriations subcommittee on the Air Force, commented.

"Negotiated procurement is the big area where we can make savings in the defense budget. We can't cut out soldiers' pay. Competitive bidding takes care of profits on contracts for ships and houses. But in fields like aircraft and guided missiles, the department just goes out and negotiates a contract. If we had some sharp business people, really working at it, I am sure we could save millions on negotiated contracts."

"The profits of big businesses with defense work are soaring sky high. There must be a reason for it. The reason seems to be that the government does not come out the gates in most of these negotiated contracts. The Negotiations Act must be enforced, but it is not the whole answer."

• **Senate Banking and Commerce Committee**, headed by Sen. William Fulbright, is awaiting a list of the 340 firms with the largest amounts of defense business before deciding on further action.

The committee's interest is to determine the effect of defense business on the financial picture of firms and the disposition on the stock market. The committee reported the list of large contractors several weeks ago but has been sidetracked by Defense Department staffs it will take at least another six weeks to compile the data under Fulbright wants.

### New Materiel Chief?

Leading candidate to succeed Lt. Gen. Brent L. Bow is Air Force Deputy Chief of Staff for Materiel, Maj. Gen. Clarence S. Irvine, now Deputy Commander for Production, Air Materiel Command. Irvine is chief trouble-shooter for AMC's commander, Gen. Edwin W. Prewing. A command pilot he flew the "Thunderbolt" when that B-29 went missing from Hase-

hida to Cairo in 1946. Gen. Bowser, who became ill on a recent trip to Germany, has been ordered by his doctors to cease aviation activity, is expected to retire shortly.

### Fare Increase Out

Chances for passenger fare increases for the airlines are dimmed, at least for the foreseeable future. RAZRZ remains in airline officials that fare increases are needed to cure worsening profit margins are laid in the delay of increase and traffic increases experienced in the past few months. Civil Aeronautics Board Chairman Ross Bailey dropped the matter at his press conference that airlines simply assumed things may look in good the future, "I will want to debate rates to get some people to ride."

### CAB Security

Efforts are being made to tighten up security in the Civil Aeronautics Board in the face of growing concern over information leaks. Chairman Ross Bailey has indicated a memorandum to the staff warning against unauthorized releases of information. Bailey has expressed concern over "violations of the open public relations of the Board," while forcing release of all information not in violation of the law.

Bailey released the matter at a press conference last week, the first held by a CAB chairman since early in 1952.

He and his staff have been busy with the other Board members and department heads on security, and his move points out to the staff possible consequences of leaks, which could lead to dismissal.

A loose spokesman in Board security has been leaks as cases which must go to the White House for approval. The problem is complicated by the fact that decisions which go to the White House are also considered through Departments of Commerce, Post Office, Defense, the Bureau of the Budget and other agencies, increasing opportunities for leaks.

### Airline Subsidy Money

There is now a good chance Civil Aeronautics Board will be voted the full \$49.2 million it requested to finance various projects to airlines by July 1. The House and the Senate will vote the \$50 million. Senate Appropriations Committee, however, ordered the \$39.2 million cut, approving the full \$15.2 million.

### Renegotiation Action

The outlook is for quick congressional action on legislation covering the Renegotiation Act and making it retroactive to Jan. 1, when it expired. House Ways and Means Committee plans consideration soon, may be pass legislation after executive consideration. Secretary of the Air Force Harold G. Goldhamer is one of the strongest supporters of retroactive. Secretary of Commerce Stephen Wicks is it is understood, is opposed, but his position was overruled when the President formally requested Congress to continue the new renegotiation law (AW Mar 18, p 15).

—Washington staff

## AMC Controller Warns Industry:

# Production Methods Lag Behind R&D

By William Goughlin

Los Angeles—A production method as old as keeping pace with rapid advances in research and development is a result, the service is deploring as weapons which it cannot produce.

This warning came last week from one of the top officers of the Air Materiel Command, Maj. Gen. F. W. Smith, in an address before the national committee of the Los Angeles Chamber of Commerce.

The AMC controller confessed that two fields vital to the operation of new weapons are in serious production difficulty.

- Jet engines.
- Atomic equipment.

"The fact is that we have more important design, but in too many instances we cannot produce items with the functional quality we need at a price which can budget in effective quantity, on time," Smith said bluntly.

"Too Optimistic—Present thinking has that one production goal, after another indicates that the industry-Air Force partnership can be developing a dangerous blind spot in production engineering, he declared.

A great strength of industry has been its co-operation in all launches and contracts, in making themselves for the new weapons," he said. "Again and again they cannot meet the production schedules which their themselves have accepted."

Major reason for this is the lack of realistic assessment of the production methods which are a great factor in production potential, the general said.

"In the long run a weapon is only as good as its production line," he said. "The stores warnings are that have been up over years as began the conversion Air Force building at the beginning of the war to know."

It has been taken too much for granted that the U. S., where mass production was born, and here we witness on the scale of production methods, the AMC officer charged.

Gen. Smith warned that the lag in production methods may cancel the edge in weapons superiority over the commonwealth that research and development has won for the U. S.

Some Air Force executives have been facing the problem squarely and solving it," he stated. "They pass on down up at the production methods, in the inflexible inflexibility of their products. More, however, have apparently not even defined the problem, much less been seen to meet it."

Lowest Development—Due to the high degree of interdependence among contractors, the general pointed out, production steps in any one of its impossible component or equipment fields can still a whole system entire, in case of a possible performance of its mission, thereby halting production to the lowest common denominator.

I think the answer to that lies in using the available level of our production engineering," he said.

Smith defined production engineering as the process by which a device is developed from the research prototype to the actual production model, and by which the production process

to be employed are then established. Agency of requirements for an Air Force—being less aware than for the planning of almost all available resources into a single program, this production planning, Smith said.

"Industry has had to make do in many instances to get the planes that air today's defense into the air," he said. "The same cannot be said to be true for that does not become a production habit with us."

Suggested Solution—To control the lag in U. S. production methods, Gen. Smith suggested:

- **As liberal as exchange** as possible of manufacturing know-how within industry, and within the trade organizations which represent it. Let's say all the concerns were to have in dialogue with known trade secrets and the share of know-how that can benefit our common cause.

- **Classification** by individual management upon a firm practice of using methods while engineering creative and thoughtful thinking on production techniques. This will assure a defense budget allows for the adapting of equipment to the production field with whatever production cost developments become available.

- **Increased recognition** by management of the production engineering function and of the production engineer as a part of the management team.

Gen. Smith and production engineers should be selected for "that creative work which we see new ways of making a better product faster and more cheaply."

He said the production engineers should be trained until he knows enough to make a decision and should be given the solid backing of management in keeping production going.

Single Spots—The general cited a number of examples of excellent production engineering in the industry, including developments in optical tooling, integrated molding, steel and titanium extrusions, new steel manufacturing techniques, rolled tapered shafts, the use of casted rings of machine tools for aircraft needs, and the production in one of critical machine tools.

But the high standard of performance is not being maintained, he charged. "It comes again and again

from the same few who are at the head of the class. They cannot carry on the defense the whole burden of one in detail program."

The new weapons control approach to Air Force procurement will help smooth the way for better production engineering, Gen. Smith said, because production engineering can begin at an early design stage. However, for actual weapons themselves will be substantially toward the peak before the contractors.

Air Force Aid—The Air Force is willing to give whatever assistance it can give, particularly in those cases where quality requirements for a new item have been developed in industry where a sharing of resources can yield immediate benefits, he declared. From 1945 to 1953 the Production Resources Division sponsored some 140 projects, ranging from studies of titanium fabrication and production to simplification of design.

# Wilson Warns Contractors on Security

By Claude Wiles

Defense Department evaluation today will be asked to conduct a public information activities, with particular emphasis on the data disclosed in their advertising, according to Defense Secretary Charles E. Wilson.

Wilson's decision was declared last week at a Pentagon news conference called for discussion of his recent order against military spokesmen and reminding that the armed forces reduce their public information staffs (AW 4-11).

Control Power—The secretary said his order was "intended to improve a recognized unsatisfactory situation" which is resulting in present of "too much information about our policies, aims and capabilities of our war equipment" for potential enemies.

"When made it clear that contractors 'will be asked to co-operate' and indicated the department has more power to control than than it has over the press because 'they are obligated' to the government.

He did not give specific estimates of reductions by industry, but said in essence that get "satisfactory information out of advertisements" and that "those are people who by to show how much they know" in news can they still be useful.

Wilson also said: "We have been put into technical information which our top people feel we should not be putting out." He did not name the "top people," but it is known that President Eisenhower has strong reservations on the subject.

Had To Defend—More of the news conference questions about Wilson's de-



Hiller Shows Off Flying Platform

Aerion flying platform, suitable for experiments by the National Advisory Committee for Aeronautics was designed last week by Hiller Helicopters, Palo Alto, Cal. Similar in most respects to the de Latham helicopter (AW 4-6 p. 7) and developed as a research tool for the Office of Naval Research, the Hiller machine is reported by a de Latham, two control rotors, rotating in opposite directions. There are two engines, together lighter than 100 hp. The device is shown by flying at the direction in which the pilot wants to go.

ment centered in its requirement that it be more security risks but also more "coordinated contractors" to the Defense Department's review.

The secretary said that it is "a little hard to define" and that questions of "policy and policy" are involved as well as secrets. Asked how this was the very thing he had in mind, he said: "We don't want to be different than them, so don't worry about that."

Another reporter pointed out that the secretary's position is similar to those respects to men transmitted by Defense Secretary James Forrestal in 1949. Wilson said it is similar, but that collapse of the National program did not mean that the program will be revised, as in 1949.

Control Power—He asked the press accordingly to "allow a little time" for the conference to meet those and indicated confidence that his action will "clear up our problems."

The secretary said that a general tightening of classification will be an extension and that the program to do this and other programs will be at the hands of his new Assistant Secretary for Legislative and Public Affairs, Robert T. Ross. Ross explained House Staff Secretary in the past last month.

Wilson declared that he did not expect more questions involving "constrictions" instead will come to his desk once his program is under way, although "it was recognized that in order to have uniform policies each system would have to be done carefully."

Military Reaction—Since distribution of the doctrine, weapons and some contractor representatives have been definitely getting information. Reaction of interested information officers to the Army, Navy, and Air Force has been to show responsibility for deciding what is "constructive" and pass all material along to the Defense Department for approval.

Wilson denied that this was the nature of his order and said there is no reason why civilian queries should not be handled in the ordinary way.

First branch of the service to get out its own directive carrying out Wilson's order was the Army. Army Secretary Robert J. Stevens told field commands that, once get their approval of the Pentagon before releasing information that deals with anything but local matters.

Tuesdayman Tamm—The standards under which information is to be denied were not automatically changed by Wilson. At one point he said he would locate the Pentagon to co-operate with a reporter working on a story out

## Home Owners Sue Lockheed

Los Angeles—A trial which will be followed closely by airlines, aircraft manufacturers and the military opened in Superior Court here last week.

The plaintiffs, 127 home owners, are demanding \$900,000 damages from Lockheed Aircraft Corp. on grounds that the "Bellman case" and various violations of Lockheed aerial spraying from San Fernando Valley Airport made them ill and nervous. Damages will be one of the first legal rulings on the question of aerial noise.

The complaint charges that for the three years ending last July when Lockheed transferred flying operations to Palmdale, both jet and propeller-driven planes from some 100 properties caused the noise level to rise 30 times a day at various times, from 25 to 300 ft. and it took from 10 to 300 mph.

Lockheed denies that the homeowners suffered any damage.





## British to Improve Bomber Range, Mobility and Accuracy on Target

London—New technical developments aimed at providing longer range, greater mobility and improved bombing accuracy for Britain's new airborne strategic bomber force, the V-bombers, seem to be stalled during a recent Parliamentary debate on the military budget.

Among the new improvements planned for the Valiant, Vulcan, and Victor are:

- **Aerial refueling tank.** These kits are being designed to convert the V-bombers into tankers capable of aerial refueling of other bombers for long range missions. No details of the kit, however, have been given, but they are believed to be similar to the type of equipment being developed by the U.S. Navy for its "hulkers" except for increasing the range of crane-based refueling forces.

- **Rock-activated missiles.** A de Havilland Spectre cold rocket kit designed to boost the Valiant on takeoff has already been publicly displayed. It is estimated that takeoff and recovery by parachute. Similar modifications are currently planned for the Vulcan and Victor to enable these bombers to use a wide variety of smaller fuels rather than to depend on a few basic types of fuel.

- **New navigation and bombing systems.** One new navigation and bombing system has been developed since 1945 and is now in production. Another new navigation system has been developed "utilizing entirely new principles" and is in production.

Undersecretary of State for Air George Ward said that the content of the V-bomber strategy paper with its atomic and hydrogen weapons stockpile had top priority in Royal Air Force planning. He said the first question of Valiants has been improved and a second question is housing. The Valiant has a better performance, according to

Ward, than the Boeing B-57, of which 12,000 are now in service with Strategic Air Command. Both the Valiant and Victor have demonstrated performance well above 19,000 ft and at high subsonic speeds, he said. The Valiant is expected to get into regular service in 1955.

- **Mobility Plans.** British plans to develop Middle East and African bases for its strategic striking forces to which it depends on mobility strategy to provide a crippling enemy attack on the basis of time. Bombing targets are also being planned for the Azores desert, and a new order plotting technique will enable accurate bombing accuracy in drops made for out of use. Canberra squadrons are being retrained through the Middle East base complex in a manner similar to the delivery of USAF bomber wings to North Africa, England and Far East on bases.

Although there are 11 projects aimed at improving aircraft development under way in Britain, there is no specific project for a supersonic bomber. Ward said the RAF is taking delay in its atomic weapons and proving these weapons at low heights. Debate also revealed that the strategic striking force would not reach an effective strength until the end of 1955 and that it is programmed to maintain and support a first line strength of about 100 bombers.

Flight simulators are being built for all three V-bomber types, with the first Valiant simulator ready for operation soon.

- **Production.** British aircraft industry produced a total of 5,600 aircraft and 12,500 engines between November 1951 and March 1953, of which about 200 were Hawker Hunter fighters and about 750 were jet bombers. Original orders for more than 1,000 Vulcan



**MAJLIG** is the Royal Navy's new disposable guided missile. Note ball bomber launch.

lighters were cut by 750 planes, and the Canberra bomber program was slashed from 1,200 to 500 planes. The "P-11" of Royal Air Force development is more than 1953 called for a front line strength of between 3,600 and 5,000 aircraft but current plans set the RAF first line strength at between 100 and 150.

The advanced Glister Javelin still being air-to-air missile is still being developed problems, but "there will be solved within the limits of current accumulated knowledge."

Ward confirmed Armstrong Whitworth's prediction (JAN Dec. 15, p. 11) that the Javelin will be armed with an all-weather guided missile in addition to its air-to-air missile. A later development of the Javelin has been ordered in a pre-production batch of 18 planes. This version will feature a three-engine and Oxygen engine replacing the Supersonic jet engine speed and better altitude performance.

Other developments revealed in the debate are:

- **Thunder bomber** is in the works with a tandem seating arrangement.

The two-seater will be used as an advanced trainer in the short RAF light training program.

- **"Ratier Project"** has completely revised Britain's early warning radar and fighter control systems with better equipment and underground control centers. This net will provide only 10 min. warning for British forces.

- **Right Coast.** It will be modified to operate with the RAF's new Coastal Command. This will be used to carry freight and an air-sea rescue unit to be obtained for passenger travel. It is expected that these Coastal Command will be used as a high speed fighter in lower England and the Western Atlantic task range in America.

- **Lowest experimental helicopter** will be equipped by the RAF and British Army to develop copter techniques for both services.

- **New anti-airborne surface helicopter** is under development.

- **Current airborne missiles** developed in U.S. and Britain have been a target for the defense against jet bomber attacks. Britain is concentrating on development on an anti-aircraft missile system that will bring down an enemy bomber well before it can achieve their reach to the U.S. Only one missile has been ordered into production—an anti-air missile believed to be the de Havilland infrared guided missile.

## Automatic System Sends Weather Data

An electronic data processing system to speed transmission of weather information to aviation facilities is in trial operation over a Houston network extending from Indianapolis to Washington, D.C. Developed under Air Navigation Development Board sponsorship, it may be the prototype of a nation-wide system for automatic handling of weather and flight plans.

Heart of the system is a large "weather memory" drum, and automatic telephone switching system, both located at Indianapolis. Latest weather reports will be stored on the drum, and auto-matically transmitted periodically via teleprinter, giving each facility only the weather information it actually requires. If a station wants more data on other geographic areas, it uses its teleprinter to interrupt the Indianapolis "storage drum."

The 10 facilities tied into the present electronic network include Weather Bureau stations at Indianapolis, Dayton, Cincinnati, and Pittsburgh; the Civil Aeronautics Administration station at Zanesville, Ohio; USAF stations at Dayton and Cincinnati Field; the Naval Air Station at Columbus, Ohio, and Capital Airport at Pittsburgh.

## Collision Warning Instrument New Avionic Need of Airlines

An Transport Airline has challenged the aviation industry to come up with a practical warning instrument, a new device to prevent collisions between aircraft, instead of whose existing and obsolete present a collision threat. The device must also automatically initiate action is necessary.

Requirement for the primary warning indicator issued from growing airport and airway traffic density that is not patrolled now by an air traffic controller during VFR conditions. The device also should provide actual during IFR conditions.

The problem of collision avoidance, "a growing much too rapidly as power of man," one airline official says.

- **Airline.** Inflight—first public discussion of collision avoidance for the passenger warning instrument came from David S. Little during Spring 1953, his meeting of the Radio Technical Commission for Aeronautics in Los Angeles.

Little, representative of airlines and electronics for American Airlines, leads the ATA VFR Committee that drafted operational requirements for the device.

Little called on the aviation industry to apply its technical ingenuity to the problem and to develop suitable equipment, although he indicated the airlines would not yet wish to commit themselves to specific hardware.

- **What Is Needed.** Operational requirements for the presently warning network, prepared by a group of airline operations and electronics experts, call for the following:

- **Detection of all aircraft** within a radius of 10 miles during enroute conditions (three miles wide in a holding pattern) and within plus or minus 500 ft of the horizon.
- **Alerting** of all aircraft within 10 miles, up to plus or minus 5,000 ft. If complete operational coverage is not feasible, at least 10 miles.

### Proximity Problem

"As air speeds of aviation increase, our chance speeds rapidly increase that point where the human eye and body are ineffective in coping with the collision problem," increasing density of air traffic aggravates this problem. Higher performance aircraft take longer and longer to actually bring a turn after the proper initial movements have been accomplished." David S. Little, speaking on the need for proximity warning instruments.

like, the forward hemisphere is covered and the most important.

- **Display of all aircraft** within distance range, showing their direction, altitude and distance.

- **Warning by audio means**, whenever another aircraft "penetrates" protected perimeter, of altitude, range and/or bearing. Although all aircraft within detection range would be displayed, ATA would like pilot alerted only when another aircraft's bearing distance and altitude present a hazard.

The problem possibility would be determined by the representative company calculating what ATA calls "the collision triangle." ATA believes that added complexity is desirable as an aid to assist the pilot with certain

- **Radio.** To handle Traffic-ATA lists now, then a dozen different possible technical approaches the industry might use to solve the problem. These range from frequency separation to vapor or smoke trails and from infrared detection peering up engine exhausts to the use of radioactive materials and detection.

ATA believes more of that will be quickly rejected as impractical, and centers its attention on two generic radio types:

- **Independent.** requiring no active cooperation from "cooperating" from target aircraft.

- **Cooperative.** requiring either aircraft to be equipped with some type of secondary equipment.

- **Independent Type.** ATA believes the most desirable independent type of warning instrument will be an airborne radar operating at a frequency of 10,000 to 10,000 megacycles. Present radar systems require power at approximately 1,500 and 2,500 mc. These very high frequencies would give inherent deflection to pick out other aircraft, not possible with the lower frequencies of radar systems.

Drawbacks of present warning radar, according to ATA, appear to be its high cost, heavy weight and the need for a large external antenna with associated critical timing requirements. Added disadvantage is that precipitation reduces the effectiveness of radar.

A simplified radio that shows only the direction of the target aircraft, without indicating its distance, might reduce the cost and weight. But this also would reduce equipment's ability, making it unable to calculate the "collision triangle."

- **Cooperative Type.** On the strength of its own limited study, ATA's VFR



**SECOND PROTOTYPE** Avon Vulcan shows new help under way for bombarding outfit.

Competitive between that cooperative type product versus one piece to be the better system ATA considers several possible approaches.

One is to use a special transponder beacon, similar to that contemplated for use in traffic control use, except that it would operate at a higher frequency. This would enable an intercepting aircraft to obtain a satisfactory bearing measure with a relatively small antenna receiving antenna. The transponder reply would be added to give aircraft's altitude, as measured by a barometric altitude transducer.

A last costly adaptation might involve a continuous down or uplink transmission from all aircraft (including barometric altitude information) but

this would not provide the distance and rate-of-change information available from independent Doppler approach is for each aircraft to transmit only information to all other aircraft in the vicinity of heading, speed and barometric altitude. While this eliminates the external rotating antenna, it complicates the computer design.

•**Orbitally Complete**—ATA's operational requirements are intended to stimulate industry thinking on the problem. If they prove unacceptable with the need for extreme reliability and availability, ATA would settle for a less complex device that merely alerts the pilot to the proximity of other aircraft without attempting to make collision possibility automatically.

Despite improvements in air-ground communications, it is not yet possible to call out specific aircraft without bothering hundreds of others, for speeds and altitudes being reported automatically instead of control, via data link, and identification by IFF.

•**Gen. Blake** reported that the Defense Dept.'s new system of auxiliary reports for aviation equipment, first discussed by *Airways Week*, (Sept. 28, p. 60) will go into effect within the next few months. Each major supplier will be advised quarterly of failures in service of its aviation products.

•**An appeal** for an industry-wide system of exchanging failure data was made by Mr. H. E. Eiser, Northrup Aircraft. Present lack of such a system results in continued use of parts that have been showing continued failures throughout the industry.

•**Aircraft equipment reliability and maintainability** continue to be major USAF problems, Blake reported. These stem from the speed with which new equipment must be rushed into production to meet jet age demands and the loss of skilled USAF maintenance personnel.

Defense Dept. studies, cited by Blake, show that approximately 10% of aviation equipment failures result from operational conditions, 50% from manufacturing defects, and other 50% or slightly less because of design deficiencies.

Read Corp. studies show that USAF spends twice as much yearly on equipment maintenance as its original cost, a figure clearly checked by Navy experience.

## Electronic System Speeds AF Supplies

An Force organization of an electronic communications system for delivering supplies began this month between Dayton, Ohio, and Newark, N. J. Substantial savings are expected when world-wide maintenance is completed. By reducing the "pipeline" time for ordering "from stock is better," USAF growth out, the system will permit re-deployment in supply inventories with no refilling inventory storage.

Dr. Decker, USAF hopes to have 55 points of the system in operation in the U. S. and there will extend overseas. Most of the system is the International Business Machines' "Inventory" for transmitting and receiving by electronic signals over leased telephone lines. Transmitters needed overseas will be linked by radio connections.

Air Force supply orders have been moving by regular and air mail, which requires weeks of time in cases of some overseas requisitions.

## Aeronautics Industry Cautions

### Airframe Makers Must Halt Raids

Los Angeles—Aircraft manufacturers are here being cautioned not to invade the aviation field and search against attempts to lure engineering talent away from present aviation fields.

Dr. Leslie Hoffman, president of Hoffman Electronics Corp., charged in a speech before the Radio Television Communication for Aeronautics that aircraft manufacturers expect to decimate their aviation engineering staffs within the next few years by luring engineers away from existing aviation companies. This would increase the number of aviation engineers working in defense plants from 6,000 to 12,000, he indicated. (The figure are based on an exclusive Aviation Week survey, reported in the December 10 issue, p. 55).

"Fraid not be possible as to why some of our friends in the aviation business feel it is necessary to continue to expand their electronic activities when the services, facilities and personnel are available for many of these functions within the already existing aviation," he declared.

•**Reply to Good**—Some observers regarded Hoffman's speech as a reply to Robert Cox, president of Lockheed Aircraft Corp., who last month declared that aviation manufacturers must stand firm against loss of air weapons business to electronic companies.

Hoffman and the aviation industry has no misgivings about aviation engineering or aviation management—unless it is used as a means of making bigger companies bigger and smaller companies smaller and results in more competition drawing to themselves all of the electronics business.

The electronics industry is not overloaded and can handle a great deal more work than it is now handling,

Hoffman said in his address.

•**Problem Clinic**—Among other problems placed before the meeting:

•**An Air Transport**—An paper calling for an aircraft's aircraft industry industry to reduce the burden of mid-air collisions was distributed (see p. 17).

•**Expanding industry**—Aeronautics needs are far exceeding skilled frequencies in the conventional radio spectrum, Maj. Gen. Gordon A. Blake, director of communications, Headquarters USAF, warned.

There is almost no limit to the amount and variety of new aviation equipment that can be built. The situation is so acute however that "if a man wishes should do an equipment with the same capability we already have, but which would use much less of the frequency spectrum, it is possible that the military would be fully justified in buying the equipment and launching an electronic replacement program which for the spectrum saving." Some techniques which hold promise of easing the situation include single channel, forward center (see p. 71), new information theory, improved directional antennas, high-power microwave tubes, and multiplexing.

Swifter point to point and air-ground communications are also pressing needs, Blake said. Air warning to the military and civil defense system depends upon the instantaneous flow of a great mass and volume of messages.

New telemetry equipment and automatic switching centers will speed the flow of information, but even these are not fast enough for modern warfare. "We need a data transmission system which will transmit without the necessity for man-to-man by a telemetry, and this is almost equally persons and things as well as messages," Blake said.

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## Turbine Plane Economy Hinges On Outcome of Fuel Controversy

By Gordon Conley

A major controversy is developing over what type of fuel to use in the transition to turbine-powered aircraft. The choice is between kerosene and JP-4.

At issue are safety, economy and availability. If the industry can resolve these points and agree on a standard fuel, oil companies will be able to cut the cost per gallon as they eliminate duplications in supply pipelines.

► **Civil Forces**—The problem now is confined largely to civil aviation, where the choice of fuel may determine the economic future and safe operation of turbo-prop or jet airplanes.

So far, only Trans-Canada Air Lines has picked JP-4. TCA decided on the wick end fuel, roughly equal to a mixture of 45% low-octane gas freedom and 55% kerosene, after studying the operational requirements of its new Vickers Viscounts in Canada.

British European Airways, Air France, Trans Australia Airlines and Capital Airlines selected kerosene for their turbo-prop-powered Viscounts.

Before the de Havilland Comets were grounded, British Overseas Airways Corp., Air France and Union Aéromaritime de Transport (UAT) used kerosene in their jet transports.

BOAC is expected to continue using that fuel when it takes delivery in 1958 on the firm of 20 Comet 46 ordered last month (AW May 18, p. 85).

► **Military Requirements**—From the military point of view, the choice of a turbine fuel presented no problem. U. S. Air Force and most other members of the North Atlantic Treaty Organization settled on JP-4 because of its universal availability.

But availability probably will give way

to technical requirements as more supersonic aircraft become operational. Fuel built up by supersonic speeds and rapid reductions in outside pressure during fast climbs can cause JP-4 to boil off.

When these high performance aircraft encounter their steepest descents, the military may be forced to switch to heavier, less volatile kerosene. An alternative is the U. S. Navy's JP-5, basically similar to kerosene but with a higher flash point.

### Air and Ground Safety

One of the basic arguments centers on the relative fire risk of kerosene and JP-4. Both can be ignited in flight or on the ground if conditions are right.

Most experts in the aviation industry and specialists for major fuel suppliers give the safety edge to kerosene

because of its higher flash point of 105°F, compared with 10°F for JP-4.

But Trans-Canada reports safety was one of the points favoring JP-4 in the bid for its 15 turbo-prop Vickers Viscounts. Studies indicated the wide-octane gas retains most index of high-octane aviation fuels, says TCA's Paul E. Lomenace, but kerosene has all three hazards plus new ones. The heavier fuel's higher flash point would give only "marginal advantage."

"The controversy over safety advantages of the two turbine fuels comes down to three main

• In flight. Heat causes JP-4 to boil rapidly at a relatively low 125°F, says Lomenace. The faster it boils, the less rich the combustion of the vapor space is ignited.

"With kerosene under similar circumstances," he says, "the fuel rate above the fuel would go from two times, through the explosive range, to six times as much as the application of heat. Boiling would occur at a considerably higher temperature (315°F) and, should preheating occur during the transition of the vapor mixture through the explosive range, a catastrophic would result."

"A fire is bad enough, but it is better than an explosion."

Other fuel experts consider that kerosene is sufficiently abundant to form an explosive cloud if exposed to high pressure or if fuel tanks are ruptured during very high rates of deceleration. But they apparently consider the chances of an in-flight explosion negligible for kerosene, JP-4 or several aviation gas.

"There must be explosive vapors in the fuel tanks during some portions of every flight," one expert says.

Carl A. Weiss, chief development engineer for Douglas Aircraft Co., gives three reasons to add fuel losses for civil transports without a tank rupture or fire due to random ignition:

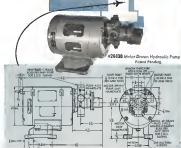
### Specification Limits for Turbine Fuels

Specification	Kerosene R.D. 2402	JP-4 MIL-PT-52-B	JP-5 MIL-PT-54
Densities			400F Min.
150° Temp.	812F Min.	270F Min.	—
180° Temp.	—	170 Min.	—
190° Temp.	—	450 Min.	—
200° Temp.	—	—	—
F. P.	152 Min.	—	500 Min.
Residue, %	2.0 Max.	1.5 Max.	1.5 Max.
Loss, %	1.4 Max.	1.5 Max.	1.5 Max.
Gravity, API	44*	44.5	44.5
Solubility in W. Min.	0.20	0.4	0.4
R.V.P. psi	Negligible*	2.8	—
Freeze Point	-40F Min.	-76 Min.	-76 Min.
Flash Point	18,000	18,400	18,300
Acid Number % Vol	20	25	25
Water Point	100F	100*	140 Min.
Viscosity	—	1.8 CS at 100	16 CCS at -100F

\*Not specified but represents a typical figure.



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- 6. AMBIENT ALTITUDE: Sea level to 40,000 ft.
- 7. FLUID: Aircraft hydraulic fluid, MIL-G 5606.
- 8. ELECTRIC MOTOR: ELECTRICAL RATING: 200 VAC—400 cycles = 2 phase, RADIO NOISE: Per requirements.
- 9. CURRENT DRAW: 20 amperes max. at rated pressure and voltage. 20 amperes max. at rated voltage.
- 10. WEIGHT: 9.50 lbs.



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CANADIAN REPRESENTATIVE: BENTLEY & BENTLEY ENGINEERING CORPORATION, TORONTO

## Air Transport Is Israel's Lifeline

(McGraw-Hill World News)

Tel Aviv—Air communications are vital to Israel. Still technically at war with her Arab neighbors, Israel has no external land transport connection. And the sea lanes to her islands are long.

Thus, El Al, the government-sponsored airline, is Israel's major traffic link with the rest of the world. In the six years of its existence, El Al has achieved, in the opinion of many foreign experts, "good progress" and displayed a high degree of initiative and dynamism. The fact that the Israelis are very air-minded has helped give the carrier a healthy boost. In 1954, El Al carried 31,064 passengers, against 44,000 for Zim, the shipping transportation company.

► **Busy Schedule**—El Al now links Lydda Airport with New York (three weekly flights), London (five flights), Paris (four), Johannesburg (one), Rome (one), Brussels (one), Zurich (one), and Istanbul (one). In addition, planes leave for Vienna, Athens and Moscow (by proxy) on frequent schedules. Freighters fly to all of these places, as well as Amsterdam.

From Düsseldorf (Germany), they bring aviation goods once a week, under the Agreement on Reparations between Israel and West Germany. The company has no direct links with Iran, China, or Russia.

El Al's 32,000 passengers in 1954 included 6,100 international travelers flying between points outside Israel. The corresponding figure for 1953 was 20,000 and 4,000. Traffic for previous years, 1951-21,000, 1951-19, 200 1950-14,700.

Three figures do not include immigrants, whose numbers are large. Immigrants are carried on both El Al and chartered planes. Out of 1,128 flights in 1954, about 950 were regular and 175 were immigrant operations. Passengers include local officials, businessmen, students and tourists, members of Zionist groups, and Christian pilgrims to the Holy Land.

El Al now handles 98% of Israel's total air business—45% of the passenger traffic, 67% of the freight and 45% of the mail. To cover its network, the airline uses a fleet of four Lockheed 049 Constellation and four Curtiss C-46 Commando (two of which are freighters). Ultralights is said to be as high as 67%. An Airspeed Consul serves for touring purposes.

► **For the Future**—El Al recently ordered three Mark 380 Britannia for its long-range routes. The purchase apparently is being financed by the government. Just how the government



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still arrange the financing is not quite laid but personally there have been some from the Chase National Bank, now Chase Manhattan Bank and some spread out of FPA's profits.

A big touring department operates in cooperation with ICAO and Indian pilots, navigators, flight engineers, radio operators, dispatchers and ground mechanics for licenses. ICAO's captain is still mainly foreign subjects, but they will gradually be replaced with locals.

For faster internal air commerce too, the government has established the Aéro Car, in which 24 A1 has a 50% interest. Aéro operates a small fleet of Comanches and de Havilland Rapides, and runs daily flights between Lodi and Elkhart on the Red Sea, and other points in the country.

The China Air Co. operates a fleet of small planes used for agricultural spraying and dusting. The aircraft are now based in Hanoi and serve agricultural settlements in some parts of the country.

El Al sends its requests for material to the BOAC base in Britain. However, last year Boeing suggested a large and replaceable repair base, scheduled to play an important part in local aviation activities. Besides, a government-controlled aviation run by American and American-trained Israeli, is reported to represent an estimated of \$2 million in foreign currency and \$1 million in local currency.

In addition to handling conventional types of aircraft, Beila has reportedly accepted equipment for the handling of jets.

Early developments in 1975 include additional technical operation and building improvements at Beila, to facilitate maintenance facilities at Hanoi which serves mainly as a base for military and National Rights at Beila and some private companies' air fields.

► **More Tourism Wanted!** El Al plans a promotion campaign in the U.S. to attract more tourists, a number drive by Air France will concentrate on Jewish groups in New York. TWA will go after non-Jewish students from most to coast church groups in the Midwest and the Pacific Coast, and various aviation associations.

Only El Al and TWA can direct flights to and from the U.S.

If some form of peace is arranged between Israel and the Arab without this world going the topic of the air line's operations to the Middle East flights now ending at Lodi might be extended to other destinations.

Political developments in the Middle East or North Africa may originate new management airline operations, such as Beila has run in the past—Mina Elapet (the Transavia airline). As Beila (the long 50%) air.

## Mexico Improves Terminal Facilities

(McGraw Hill World News)

Mexico City—Mexican aviation recovered from the 40% cancellation of the Mexican carriers in April of last year after the government granted general fare increases of 20%.

Mexico's lowest single air route—the American flight between Mexico City and Acapulco—saw a record number of passengers on the one-hour flight with its new fleet of Comanches. The new 1200-hour airport in Acapulco, located on the opposite side of the city from the former field, was placed in service in December and provides more rapid handling of passengers as well as greater comfort through its handsome new waiting rooms, restrooms, ticket and baggage offices etc.

At the same time, Aeromexico's January inaugurated its first direct flight between the U.S. and the former Acapulco airport. The flights will be non-stop from Tijuana on the U.S. border directly to the Acapulco airport. The young passengers from California have had to give up of Mexico City, which usually meant an overnight stay in Mexico City.

Compania Mexicana de Aviación, Mexico's largest domestic carrier, has its domestic routes to nearly all parts of the country. It has added several new ones.

CMA, an affiliate of Pan American, is reported to have ordered three DC-7s—the last of this type to be ordered by a Mexican airline. It is said that this plane will be used on a new CMA route, starting in New York City, from the Mexican capital. Confirmation of this has not yet been forthcoming.

The new Mexico City central airport, which went into service in the early part of last year, has given aeromexico, Aeromexico, and its operations has been well, approved. The hardware \$15-million structure, one of the largest in the world, can handle up to 14 DC-6s at a time and is capable of handling 17,000 passengers a day.

The arrangement for international passengers in the new airport has been particularly successful. It follows an extremely good traffic pattern which permits visitors to see passengers right from the plane, speak to them about a travel or guide agent and then follow their route through the immigration and customs by watching the passengers through glass windows from a central waiting room.

In effect, the incoming passengers go in a U-shaped tunnel around the waiting room which has glass glass on all sides.

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## AVIATION CALENDAR

Apr. 18-23—Society of Automotive Engineers Golden Anniversary Automatic Meeting, Automotive Production Forum and Aircraft Engineering Display, 1800 Butler and McNamara Roads, New York

Apr. 18-21—American Society of Mechanical Engineers, Diamond Jubilee spring meeting, including first aviation symposium, Lord Baltimore Hotel, Baltimore

Apr. 20—American Rocket Society, spring meeting, Baltimore

Apr. 24-25—Aircraft Operators Council, eighth annual meeting, Seattle

April 25-May 6—International Air Transport Association, eighth technical conference, San Juan, P. R.

Apr. 25—Fleet & Whitney Aircraft, East 1915 forum on engine operation and maintenance, East Hartford, Conn. Other forums Seattle, May 15; Oakland, May 17; Boston, May 18; St. Paul, May 24; Chicago, N. J., Sept. 14; Miami, Sept. 15; Dallas, Sept. 22

Apr. 25-26—Society for Experimental Stress Analysis, spring meeting, Hotel Statler, Los Angeles

Apr. 25-26—American Helicopter Society, 11th annual forum, Hotel Mayflower, Washington, D. C.

Apr. 28-29—Michigan Aeronautical Conference, University of Michigan, Ann Arbor

Apr. 28—Institute of Navigation, aviation regional meeting, Friendship Airport, Baltimore

Apr. 28-30—New England radio-electronics meeting, sponsored by Boston and Connecticut Valley sections of IRE, Sheraton Plaza Hotel, Boston

Apr. 30-May 1—Fleet Air, Shuman Wing convention, Shuman Island, Chicago

May 1-5—Society of Aeronautical Weights Engineers, national conference, Hilton Hotel, Ft. Worth

May 3-5—International Society of America, first annual Flight Test Instrumentation Symposium, ADA Hotel, Wichita

May 4-6—Fourth International Aviation Trade Show, 8th Regiment Armory, New York

May 6—First International Aircraft Meet Exposition, Wall Ropes Memorial Coliseum, Ft. Worth

May 15—National Inter-Collegiate Flying Assn., annual convention and air meet, Mechanics Field, Ft. Worth

May 18—Association of Northeastern College Flying Clubs and club airfield open aircraft, Troy (N. Y.) Municipal Airport

May 19-23—National Conference on Aeronautical Electronics, Baltimore Hotel, Dayton

May 18-National Fire Protection Association, aviation seminar, Netherland Plaza Hotel, Cincinnati

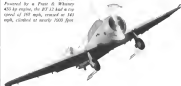
May 18-20—National Materials Handling Exposition, produced by Cliggo & Polak, International Amphitheatre, Chicago

May 18-20—National Television Conference, Museum Hotel, Chicago

May 21-24—American Society for Quality Control, ninth annual convention, Hotel Statler and New Yorker, New York

May 28—Federation Aeronautique Internationale and ICAVL, Royal Netherlands Aankicht 18th International Air Display Tjallingii Airbase, The Hague

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**WHEE ON RANGE** At Area 1 White Sands Proving Ground, some of the launching and handling equipment taken into the field.



**READY ALERT** Nike missiles are stored in two months in underground magazine. Here they lift loads to surface in a long



## How a Weapon System Operates in Field

By David A. Anderson

The Nike network, now assigned to the defense of 11 major American cities, furnishes an excellent example of field operations with one of the first weapon systems to be developed.

With nearly 100 Nike sites to be activated in the near future, the Army faces the multiple problems of constructing, equipping, supplying and protecting missile batteries stationed from New York to Los Angeles.

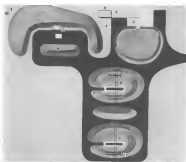
These problems are complicated by the continuing development of the rocket itself, which requires feeding improvements into each of the battery sites as fast as production keeps them out.

Army's initial intention was to treat Nike like any other piece of ordnance, to handle it with standard procedures from receipt in field use, to overhaul, maintain and update the system like any other item of field gear.

That decision—now modified only slightly—has paid off in the operational use of the first antiaircraft missile system.

► **Background**—Nike is probably the oldest weapon system extant. It began as a practice project under the control

NEW YORK DEFENSE is the responsibility of these proposed Nike batteries.



**LAUNCHING SITE** for Nike's direct (1) and storage, (2) and testing, (3) generator building, (4) 10 ft 4 in. tall, (5) maintenance pit, (6) missile assembly and test building, (7) its quarry charger pit, (8) underground missile storage, (9) earth bank around right (left high, (10) and (11) launchers. This site is separated from the guideway area by about 1,000 ft.

of Bell Telephone Labs, and from the first was organized along the system's control loop known to the communications industry.

Nike production responsibility is divided roughly half and half between Bell's manufacturing affiliate, Western Electric Co., and Douglas Aircraft Co. Western Electric builds radars, command and control trailers and other gear; Douglas responsibility is for the missile airframe, launcher and control gear.

► **System Assembly**—The first time the components are married into a system is after delivery to the Army in its Ft. Bliss White Sands Proving Ground area.

Meanwhile, the battery has been sited and in a way, and its personnel have been going through the training procedures and extra indoctrination required. The 100 officers and enlisted men are chosen out of the top of the Army's lists. Many of the officers have engineering or scientific degrees. The enlisted men

get nine extra months of schooling at their own or technical institutions, three months of this are to maintain or propagate specialists.

These men work on the equipment that will be assigned to their battery. They assemble it, check it out, and get it ready for the field, under the watchful eyes of factory technicians and instructors.

► **Out to Launch**—The package out of battery and area is formed. They make up a company and return out to the Tableaux base, where a field battery is set up at the Red Canyon Range Camp area.

Under operational conditions, the battery fires its first rounds. They launch a few practice missiles, then get a shot on a live run against a drone aircraft, usually a B-17.

After shooting down the drone, their practice rounds are over. The next move out of the range camp is a tactical site visit (a day).

► **Site Choice**—Selection of the area for the battery has been previously made, so that the unit can move right in and set up. These basic considerations govern the site location: meteorological, industrial layout and logistics.

About 60 acres of land is needed for a single battery. Of this, about 30 acres is the buffer zone, this land can be used by a farmer, for example, or can be used for domestic animals, it must not contain houses, nor places where crowds would naturally gather, like picnic areas.

Agreement of the land is the biggest problem facing the local anti-aircraft commands. No community, even when its own defense is at stake, delights in having a military and more so. In addition, lack of a useful positive public relations program has hampered the Army in its attempts to convert the community at Nike's values.

► **Site Layout**—A Nike site consists of two parts, each of about 15 acres, and located about 1,000 yd. apart. The guidance equipment and the stream intake and heating facilities are together in one area. The other contains the underground magazine, testing and storage chambers and the launchers.

Regard distance between the Nike battery in the field and at a fixed site is the underground magazine. Here is a concrete storage vault about 58 x 62 x 13 ft. are stored the ready missiles.

Other equipment in the launching and guidance area is the same in fixed and in the field, with the exception of the semi-permanent system of launching.

The entire field system is air-transportable, so that the working units of a battery can be moved to the field in special units or for security from one location to another. For this reason, magazines have been used in a warehouse, the trailer units are built largely of a magazine-





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## How the Systems Concept Originated

Credit for originating the systems concept could be assigned to the Bell Telephone Co., which coined the name "Bell System" during the latter part of the 19th century.

Said a Bell spokesman, "If we had'st worked along the lines of the systems concept, you still wouldn't have telephone service."

Application of the systems idea is a unique case about which Bell's experience during World War II. The law was responsible for only a part of Army's own aircraft control systems, and continuously heard complaints from the field about unsound safety, at which time work was only a part.

After the war, when Army asked Bell to investigate a missile system, the firm suggested as strongly as possible that it be done according to the available ideas of a systems concept. Army agreed, and Nike was the result. After a preliminary design study of five months' duration, Douglas Aircraft was called in as an equal partner.

per interconnect for lightning

► **Tactical Operations**—A tactical battery unit receives Nike missiles in approval, shipping instructions from the battery. They are delivered to an assembly and test building where the subunit, booster and launching rail are attached.

After checkout of the mechanical and electric gear, Nike is moved to launching station and filled. It is now a live round, ready for immediate action.

In that condition, it is taken to the underground magazine and stored in a ready alert condition. Periodic checks of various equipment and inspection of maintenance parts will continue during the short life of the missile.

For long, the missiles are moved from the underground magazine into an elevator in the center of the vault. On the surface, the Nike are transferred from the launchers ready to take

on either side of the elevator shaft. During launch, the elevator unit is shaft to generate any bleed-down into the magazine.

► **Training**—During the time a tactical unit is on a fixed site, there is constant training of the battery, with special emphasis on radar tracking. Commercial planes are tracked for practice.

In addition, drills are held into de-ice areas and Nike batteries go into action, stopping short of firing a live round. They are simulated dry runs with dummy rounds that never get off the ground, to maintain proficiency in handling and handling techniques. But the battery never knows until the last second whether or not an alert is a positive system or the real thing.

Over each year, the battery moves from its tactical site back to the Tullahoma base in New Mexico to live on



**CONTROL AREA** for Nike: (1) base lighting unit; (2) maintenance pad; (3) frequency changer and generators; (4) spare parts van; (5) radio control trailer; (6) battery control trailer; (7) acquisition radar; (8) missile tracking radar; (9) target tracking radar; (10) supply Mfg.; (11) fuel oil storage; (12) administration Mfg.; (13) main hall; (14) barracks; (15) mess; (16) BQ; (17) motor depot.

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other live round against a target drive. As in their early training, they work under field conditions.

► The Mkrwan-Nike jets are located for close-in defense of cities. The assumption is that the majority of the enemy bomber fleet will be knocked out at some distance from the target by interceptor aircraft, and that Nike will have only the last remnants of the attack to shoot down. In this respect, Nike performs the same function as anti-aircraft artillery.

An early warning alert is posted to batteries in a target area during an enemy attack. The alert specifies the direction of attack, among other data. Nike takes go into action, working the attack error to put up the bomber fleet coming in. The acquisition radar lock on to the selected target within the fleet, while other radar keep tracking the rest of the attacking force.

At the first alert, battery personnel get the missiles ready for the attack and perform final readiness checks of equipment.

All safety locks and controls are removed, the live missiles are rolled out along the ready racks and others are prepared in the sequence to replace the fired Nikes.

The tracking attack crosses the distant deadline, and the battery commander gives the firing order. Nike cuts off the launcher, reaches supersonic speed before booster dropout. At separation, the booster tumbles to its point in the buffer zone and Nike barrels upward to destruction.

► Systems in Use—These descriptions apply only to the Army's Nike anti-aircraft missile, but they are typical of the kind of operations that a missile system would undergo between the formation of units and tactical systems.

Other systems in the field include the Army's Corporal rocket, manufactured by Firestone and Collins Brothers, and USAF's Matador, built and developed by the Glenn L. Martin Co.

Final fruits of the missile systems concepts have yet to get into military use, although the three missile systems named above will shortly be tested by others.

But as in the case of design, development and production, the operational use of a weapons system forces a different approach to an old problem—the efficient use of a military machine.

## Engineers Form Die-Casting Society

A new technical group has been formed to develop modern standards for the die-casting industry and exchange, accumulate and disseminate data.

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## Rocket Propellants Subject of New Study

Combustion control of solid propellant rockets will be one of the subjects of a new research program at Princeton University's Ferrell Research Center under sponsorship of the Aerojet General Corp.

New solid propellants of the composite type—using a plastic binder-fuel and a granulated oxidizer—have made it possible for engineers to design a special propellant combination for each category of rocket (parapet).

But the engineer must be able to calculate the burning properties of the propellant from its chemical formula. This is only possible with very complete data on the basic physical properties of combustion.

Aerojet's grant has no strings attached, there are no limitations on the research program imposed by the company.

The results are to be published in scientific journals and made available to rocket engineers and designers with an interest in the subject.

The solid propellant burning program is led by Prof. Martin Sussmanfeld, assisted by graduate students George S. Sutherland and Dwight A. Mahoney.

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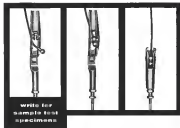


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"But to code our scientific literature or our legal documents or any other part of our recording records and then to place them under the control of machinery responsive to our will is a stupendous undertaking. . . . It would pay everyone, and the expense should therefore be borne by everyone. Thus it is a task for government. But it is possible for a government which cannot even mechanize its postal system to be frugal and conservative enough to undertake a task of such complexity and such magnitude? Probably not."

—From an address by Vannevar Bush, president of Carnegie Institute of Washington, before the American Society of Mechanical Engineers.

The science and comic aspects of space flight received a thorough treatment on TV recently at the hands of Walt Disney's outstanding crew. The best from Uncle Walt's Mouse House really could themselves as a graphic, animated presentation of the possibilities and problems of that first flight into space.

Highlights of the heart-lung program —for two small boys who are related to me—was the final episode a magnificently done interpretation of the first flight. All three of us watched through the windows, upstairs through walled stage and each successive stage being: we were used at the sudden silence when the motor shut off and we started jolting in the blackness. We failed to reverse thrust and start the long fall toward earth.

The drama of the last few moments was as great as that of the first few. The spell of background music and the mad panorama of earth speeding below worked its magic, and we there watched the delta-winged rocket glide down through clouds to the concrete strip. We watched that bit through wire eyes, all three of us. They worked so badly to grow up quickly, so fast they could go. And I had grown up too quickly, and already am too old—DAA.

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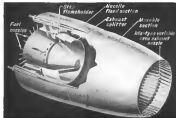
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## PRODUCTION



20-10 RAMJET spews fiery exhaust during test in Marquardt's jet laboratory. Air storage tanks are behind test rig.



AFTERBURNER for advanced type, high-power jet engine, has jet-type nozzle-as nozzle. Photo at right indicates size.

## Marquardt Pushes Supersonic Projects

By Irving Stone

VAN NYS, Gold-Marquardt Aircraft Co. has established itself firmly in the field of aircraft propulsion in just 10 years since its founding with a capital of \$1,000.

While the bulk of Marquardt's efforts has been directed toward supersonic swept development for guided missiles, the company has also developed related engineering versatility covering afterburners, reverse thrust units, auxiliary drives, fuel controls and pumps, and emergency powerplants.

Marquardt's engineering skills into three main categories—powerplants, accessories and tools. These three divisions are supplemented by a fourth

division—long-range planning and research—which reports directly to Roy E. Marquardt, president.

The powerplant division works on subsonic and supersonic engines, afterburners and reverse thrust devices.

► **Subsonic:** Ramjet-supersonic swept development is getting the emphasis at Marquardt today, but subsonic swept work still continues.

In the subsonic field, Marquardt's powerplant engineers are developing ramjets as booster units for helicopter rotor tip applications. Basically, these engines are "two-dimensional" configurations designed to flow far into the blade tip, or are collapsed as part of the tip when not in use.

This work is being done under a

contract for final development of the rotor tip modification for Wright Air Development Center. At this point, it has not yet been decided whether the fans or the collapsed (such as a pure) (logically) configuration is more feasible.

Stretching out behind this subsonic swept work is a long list of subsonic engine developments. Among them is the G-20-157, a 20-in.-diameter swept which was used to power the Mach X-15. Flaver, Navy target drone. About 600 were produced.

In 1951, the swept was flown for 15 min. in a X-15, an endurance test which has not yet been equaled in swept flight. Marquardt swept also hold records for speed and distance.

► **Supersonic:** John-Scout of its super

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computers are being applied by the  
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the information processing  
and computing functions of  
large ground water transport  
control systems.*

The application of digital and computer technologies to the problems of large-scale molecular networks has created new problems at all levels in the General Systems Department. Experiments and phenomena with extremely greater field-effect, as well as macroscopic objects, are involved in computer modeling as

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TRANSISTOR CIRCUITS  
DIGITAL COMPUTING NETS  
MAGNETIC DRUM AND CORE MEMORY  
LOGICAL DESIGN  
PROGRAMMING

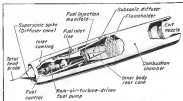
VERY HIGH POWER MODULATORS  
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### Keywords and Important People

HUGHES

RESEARCH AND  
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Culver City, Los Angeles County, California



**SUPERSONIC RAMJET** development at Moscow's D. Bryukov is headed by the engine bureau



VARIABLE-AREA NEEDLE is fully open (right) in the photo of *Margamidi albifrons*.



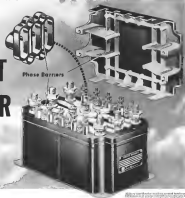
**THRUST REVERSER MODELS** incorporated in two engine pods. Bottom view shows cruise attitude, with thrust reversers retracted. Manoeuvre has achieved 10% thrust reversal

sonic development is tied in with Boeing and Lockheed projects. Engines for these applications are being developed for speeds several times that of sound. The next engines for the Boeing and Lockheed applications basically stem from the same engine with variations for their specific demands.

for useful production and has considerable potential for growth. It embodies selected traits for good percent recovery, a fuel injection system for good atomization over a wide range of percent air/fuel, and a flameholding mechanism which is very effective—prevents a big problem in engine development.

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CIRCUIT  
BREAKER  
FOR A-C  
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The new Jask & Heintz Model 50000 Circuit Breaker is designed to meet MIL-C-33794 (ASG) . . . provides a continuous rating of 175 amperes (50 kva) . . . weighs just 6½ pounds! Although an important part of the complete Jask & Heintz a-c system "package", it can be supplied as an individual unit if desired.

In addition to its main features described at right, this new breaker has many other distinct asset positive, trouble-free functioning under extreme environmental conditions. Here is another example of how Jack & Heintz continues to provide you with advanced electron systems and components through integrated engineering and manufacturing. For complete information write to Jack & Heintz, Inc., 17935 Broadway, Cleveland 1, Ohio. Export Department, 13 E. 40th St., New York 16, N.Y.

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MARQUARDT

Nery E. Marquardt, president of Marquardt Aircraft Co., at 37 can look back at an impressive record in testing, research, development and manufacturing. He received his B.S. in Aeronautical Engineering in 1940 at California Institute of Technology, his M.S. at the same school in 1942.

Following this, he went to work for Northrop Aircraft, in charge of Nery research. At the same time he taught at the University of Southern California. He had also taught at Cal Tech and became Director of Aeronautical Research at USC in 1944. Subsequently he left Northrop.

In 1944, Nery Marquardt, with some engineers and business men, founded the Marquardt Aircraft Co. to subcontract the construction of the actual engine. Began with a capital of only \$1,000 in November 1944, Marquardt Aircraft is the last more than \$1,000 employees and sales reaching a 10 percent rate of engine nearly \$70 million per year. Marquardt's plant now is about 500,000 sq. ft.

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using a technical assistant for June on the West Coast. The company wants to bring together in a closed meeting a select group from the major aerospace leaders to reveal details of what the supersonic engine will be. It will also cover hypersonic and "coaster" fuels for speeds up to Mach 5.

Engineers on this supersonic engine already have been recruited from several aircraft companies who are interested in using it in a series of thrust segments that all the main engine at very high altitudes and speeds.

► **Housed in Tip Pods**—One way of utilizing a engine is as an additional engine in the super-thrust, super-speed engine would be to house the engine in wingtip fuel tanks. These tanks would feed the main engines and be emptied before the main fuel tank would be beyond.

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**FOR HELICOPTER BOOST**, Marquardt developed the experimental, "breakdown at" intake nozzle. Free end (top) shows leading edge wider. Trailing edge (bottom) has variable exhaust cone.

the nose and tail finings as the turbine would be lifted off and the nozzle fed with fuel from the aircraft tank. After the mission was completed, the aircraft could be dropped, if the pilot did not want to take the drag penalty.

► **Metal Shams**—Big problem with nozzles will be protection of alloys that will take the extreme temperatures created by new fuels now in the research stage. One possible solution to this problem is the current (sintered metal combustion), this type of material is under investigation in connection with engine nose cooler development.

Marquardt now uses an exhaustor stream thrust, except for nose section boosting, which is 245T. Don's HRTI sheet is being studied as a substitute for the 245T, and also to extend its use further into the hot region to take temperatures of 600F, and to cut engine weight.

► **Afterburner Beginnings**—Marquardt made its entry into the afterburner field with a good basic complement of engineers who had picked up considerable know-how with McDonnell Aircraft Corp.

McDonnell had need for a special short afterburner for its F-101 Voodoo. As the engine industry was not prepared to build this unit, McDonnell set up its own afterburner capabilities. The company finally had to decide whether to stay in or get out of the afterburner business, and decided to get out. Marquardt saw the possibilities of the afterburner field and its similarity to rocket work, and found a group of 10 McDonnell engineers. Six of five original group are still with Marquardt; one of them is John Weston, now chief engineer of the present division. He was with McDonnell from

1944 to 1957, associated for an of the eight years with powerplant work as aircraft, pressure jets and afterburners. ► **Advanced Projects**—Marquardt is engaged in afterburner and variable-area nozzle development for very advanced, high-power jet engines, now in the development stage.

Key goals in this Marquardt development project are to boost combustion efficiency and reduce the weight of the afterburner for higher temperature applications.

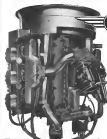
One of these high thrust engines already has been run on the test stand with its afterburner installed but inactive, while the nozzle has been used

Marquardt's work on variable-area nozzles is believed to incorporate conventional flow principles for supersonic applications. The conventional design assumption might be obtained physically (with metal) or dynamically.

► **Small Jet, VTOL Studies**—Marquardt is now making proposals to construct afterburners for some of the small, lightweight military high-thrust turbojets. Company engineers have come to the conclusion that it is feasible to design a very lightweight afterburner to greatly boost the performance of this type of small jet engine.

Some of the thrust-to-weight ratios

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involved with this type of engine fitted with afterburner may run about 12:1, Aviatron West has learned.

Marquardt also has begun studies of various forms of afterburning devices to supplement jet engines in VTOL aircraft.

**Work for Westinghouse**—The company is conducting combustion development work for Westinghouse, checking the feasibility of various burner configurations for future afterburner applications. This work, as being done in the Long-Range Planning and Research Division.

Both of the company's afterburner work has been in cooperation with the Westinghouse J40 and J45 powerplant projects.

The J40 afterburner module had a unique expander and made of 1,601 bolts with a high temperature film glass packing attached with an cap. The railing was necessary because the temperature at the surface of the afterburner module was in the region of 1,800,000°F.

When the J41 version of the J40 engine was cancelled, Marquardt's development work on the specific afterburner also ended. Work also was completed on the afterburner for the J46, but Marquardt engaged in additional afterburner development work in its own facilities by simulating engine work and pressure especially associated with the turbine.

**Titanium Welding Development**—In cooperation with afterburner should research and general metallurgical development. Marquardt is investigating the problems of welding titanium and its alloys.

For resistance-welding of the material, Marquardt technicians have developed a technique of producing the sheet at the weld area by resistance heating in the welding machine. This method is well suited to the resistance of the base metal.

This technique permits use of a lower welding heat input and for a shorter time. This also requires oxygen and nitrogen at the weld area.

A postheat treatment is used to control the cooling rate. This postheating is the reverse of the postheating cycle—reaction in welding machine's current in effect, postheating is a slight annealing action.

**Thrust Brake Work**—Reverse thrust development at Marquardt is concentrated. Marquardt engineers believe that even with other a big deal, and most thrust reversers will be joined applications—there will be no dual package configurations. Nevertheless, it is not full that the reverse is as much a part of the powerplant as is the afterburner.

Brake work in the motor field at Marquardt has been developed along

the concept of having vanes and actuated linkage (controlling powerplant scheme). With this arrangement, a reverse thrust of about 50% has been achieved, with the forward flow directed at about 45 deg. to the centerline of the jet.

The 45-deg. angle is desired to avoid gas diffusion with the ambient air to prevent accumulation of the hot exhaust gases into the engine inlet—condition normally pronounced with engine pod installation.

Marquardt also is working on other reverse configurations. These are target types which afford up to 50% reverse thrust, but in actual practice it may be

necessary to reduce this percentage because of the problems of accumulation of hot gases into the engine inlet, the company believes.

Some ratios between 50% and 60% reversal may be achieved, it is felt, and that would be a good gain.

Marquardt is not working in the target type of reverse under contract now, but it may end up as a military installation shortly. It may include a few burning vanes to direct the reverse exhaust away from the fans.

(This is the first of two articles on Marquardt Aircraft Co. developments in aircraft propulsion.)



HOODBEAMS #3

While pop music's dream about Southwest Airplane ads, some artists in such as April First (Boston) for independent releases, prankish music is the frequency, 25, 25 - 125 Hz, black level, brown and

Pops, being a pilot, is used in this kind of career on, regularly, suffering through a mean known to The Old Promised Delivery Date. Windows, applied with time his flying machine gets into the shop for a check or overhaul. Getting the dream thing back on again is even tougher than getting a new one of a flying. These days

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been certified by Magnatrol Aircraft Co., Van Nuys, to speed processing aircraft engine test information.

► **Rayco Corp.**, maker of high-speed mechanical cranes, moved to 240 Harbor Blvd., Belmont, Calif.

► **Avanti Products Division** of Century Controls Corp., Farmingdale, N.Y., appointed Seidler Engineering Co., Tulsa, Okla. as manufacturer's representative for Texas Oklahoma Kansas and Missouri.

► **Bachner Tool Corp.**, Millenburg, Pa., purchased Norton Machine Works, Detroit, for \$780,000. Motion facilities will be moved to Millenburg. New divisions make parts, clamps, clamp assemblies and fixture components.

► **Integrated manufacturing** system is a new method of manufacturing documents, maps and graphs resistant to 100 heat or so heat, developed by Photocopying, Inc., Silver Spring, Md., for the Office of Naval Records. IMB comprises three principal parts: reduction copy, print, and duplicator. Copy and print either 35 mm. or 70-mm. color or black-and-white film.

► **Ditton Engineering Corp.**, maker of transducers and electro-mechanical equipment, moved to Mid-Continent Manufacturing, Inc.'s, Madison, Wis., facility. Ditton is a Mid-Continent subsidiary.



### Plastic Tent Allows "Clean" Titanium Welds

Because carbon-free titanium absorbs any gas from the atmosphere that tend to weaken welds, Sola Aircraft Co., Des Moines, ran this sealed steel plastic tent to keep air away from fusion welds while work is being with in heat gun. The graphite covered tent is fastened to stand and holding table. The operator can keep solder pliers that are attached to the tent's joint leg to allow freedom of movement.

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• LETTERS

applied to helicopters and reconnaissance as well as to the Lockheed and Carrier prototypes. The Phase II studies, the 300-watt version could also be included in the VTO category. The applications of heavy-duty aircraft and conventional aircraft were being comparable performance in most conventional aircraft.

We propose the use of the Team Ship Concept Award (SCA) to develop the series of aircraft. The conventional aircraft could be distinguished from SCA by the term TCA, or Tactical Ground Attack. Perhaps your readers have better thoughts on this not too important problem.

James L. Stevens

The David S. Lawrence Corporation  
Aviation Safety Center of Canada  
University  
411 Park Ave.  
New York 22, N. Y.

## Industry Defender

Mr. Menden's letter (JAF, May 7, p. 77) made me very angry, and I can see no reason for publishing such a letter in an aviation magazine. In fact, I feel somewhat ashamed for having introduced in a publication which depends on little funds in the industry if it is supposed to represent. Am you going to let this attack continue to tell the world that your magazine chose the highest degree of a dishonest industry? Our lack of Mr. Menden's letter and the magazine from Patrick will demand that all aviation organizations be stopped immediately.

"We defend" does there has been no advance in 10 years? It is so happens that I have spent just about 30 years in what Mr. Menden refers to as an inefficient and incompetent industry, and it seems me to read complaints from "our heroes." Mr. Menden must have a lot to offer if it took him more than 10 years to find a job in aviation.

The big building started about 1950, and most airlines had closed down by 1960. Between 1950 and 1960, the aviation industry was forced to take whatever they could get in the way of passengers to fill the gaps caused by the airlines that had overbooked in the industry. Passengers had to live with who knew nothing of all about airplanes, and they even lived over who believed that airplanes are built like bridges. When we start building airplanes to the standards of bridges, construction, you can forget all of your past years in the industry. The industry will be no aviation industry.

"Reasonable Return" I do not dispute that there is a shortage of trained, experienced aircraft engineers, but, the way other industry, the aviation industry expects a reasonable return on its investment. In developing particular skills management is only following sound business practices, have a specialist for a specialist job and the specialist can keep about the job.

Mr. Menden wants a job in aviation, he must show some initiative. I suggest that you direct his attention to the engineering opportunities offered in the "Spaceflight Section" of Aviation Week. Let him spend 30 years in a "Goldcoaster" (freight-bearing) industry, and he will have the job position and experience and

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16200V, 16320V, 16440V, 16560V, 16680V, 16800V, 16920V, 17040V, 17160V, 17280V, 17400V, 17520V, 17640V, 17760V, 17880V, 18000V, 18120V, 18240V, 18360V, 18480V, 18600V, 18720V, 18840V, 18960V, 19080V, 19200V, 19320V, 19440V, 19560V, 19680V, 19800V, 19920V, 20040V, 20160V, 20280V, 20400V, 20520V, 20640V, 20760V, 20880V, 21000V, 21120V, 21240V, 21360V, 21480V, 21600V, 21720V, 21840V, 21960V, 22080V, 22200V, 22320V, 22440V, 22560V, 22680V, 22800V, 22920V, 23040V, 23160V, 23280V, 23400V, 23520V, 23640V, 23760V, 23880V, 24000V, 24120V, 24240V, 24360V, 24480V, 24600V, 24720V, 24840V, 24960V, 25080V, 25200V, 25320V, 25440V, 25560V, 25680V, 25800V, 25920V, 26040V, 26160V, 26280V, 26400V, 26520V, 26640V, 26760V, 26880V, 27000V, 27120V, 27240V, 27360V, 27480V, 27600V, 27720V, 27840V, 27960V, 28080V, 28200V, 28320V, 28440V, 28560V, 28680V, 28800V, 28920V, 29040V, 29160V, 29280V, 29400V, 29520V, 29640V, 29760V, 29880V, 30000V, 30120V, 30240V, 30360V, 30480V, 30600V, 30720V, 30840V, 30960V, 31080V, 31200V, 31320V, 31440V, 31560V, 31680V, 31800V, 31920V, 32040V, 32160V, 32280V, 32400V, 32520V, 32640V, 32760V, 32880V, 33000V, 33120V, 33240V, 33360V, 33480V, 33600V, 33720V, 33840V, 33960V, 34080V, 34200V, 34320V, 34440V, 34560V, 34680V, 34800V, 34920V, 35040V, 35160V, 35280V, 35400V, 35520V, 35640V, 35760V, 35880V, 36000V, 36120V, 36240V, 36360V, 36480V, 36600V, 36720V, 36840V, 36960V, 37080V, 37200V, 37320V, 37440V, 37560V, 37680V, 37800V, 37920V, 38040V, 38160V, 38280V, 38400V, 38520V, 38640V, 38760V, 38880V, 39000V, 39120V, 39240V, 39360V, 39480V, 39600V, 39720V, 39840V, 39960V, 40080V, 40200V, 40320V, 40440V, 40560V, 40680V, 40800V, 40920V, 41040V, 41160V, 41280V, 41400V, 41520V, 41640V, 41760V, 41880V, 42000V, 42120V, 42240V, 42360V, 42480V, 42600V, 42720V, 42840V, 42960V, 43080V, 43200V, 43320V, 43440V, 43560V, 43680V, 43800V, 43920V, 44040V, 44160V, 44280V, 44400V, 44520V, 44640V, 44760V, 44880V, 45000V, 45120V, 45240V, 45360V, 45480V, 45600V, 45720V, 45840V, 45960V, 46080V, 46200V, 46320V, 46440V, 46560V, 46680V, 46800V, 46920V, 47040V, 47160V, 47280V, 47400V, 47520V, 47640V, 47760V, 47880V, 48000V, 48120V, 48240V, 48360V, 48480V, 48600V, 48720V, 48840V, 48960V, 49080V, 49200V, 49320V, 49440V, 49560V, 49680V, 49800V, 49920V, 50040V, 50160V, 50280V, 50400V, 50520V, 50640V, 50760V, 50880V, 51000V, 51120V, 51240V, 51360V, 51480V, 51600V, 51720V, 51840V, 51960V, 52080V, 52200V, 52320V, 52440V, 52560V, 52680V, 52800V, 52920V, 53040V, 53160V, 53280V, 53400V, 53520V, 53640V, 53760V, 53880V, 54000V, 54120V, 54240V, 54360V, 54480V, 54600V, 54720V, 54840V, 54960V, 55080V, 55200V, 55320V, 55440V, 55560V, 55680V, 55800V, 55920V, 56040V, 56160V, 56280V, 56400V, 56520V, 56640V, 56760V, 56880V, 57000V, 57120V, 57240V, 57360V, 57480V, 57600V, 57720V, 57840V, 57960V, 58080V, 58200V, 58320V, 58440V, 58560V, 58680V, 58800V, 58920V, 59040V, 59160V, 59280V, 59400V, 59520V, 59640V, 59760V, 59880V, 60000V, 60120V, 60240V, 60360V, 60480V, 60600V, 60720V, 60840V, 60960V, 61080V, 61200V, 61320V, 61440V, 61560V, 61680V, 61800V, 61920V, 62040V, 62160V, 62280V, 62400V, 62520V, 62640V, 62760V, 62880V, 63000V, 63120V, 63240V, 63360V, 63480V, 63600V, 63720V, 63840V, 63960V, 64080V, 64200V, 64320V, 64440V, 64560V, 64680V, 64800V, 64920V, 65040V, 65160V, 65280V, 65400V, 65520V, 65640V, 65760V, 65880V, 66000V, 66120V, 66240V, 66360V, 66480V, 66600V, 66720V, 66840V, 66960V, 67080V, 67200V, 67320V, 67440V, 67560V, 67680V, 67800V, 67920V, 68040V, 68160V, 68280V, 68400V, 68520V, 68640V, 68760V, 68880V, 69000V, 69120V, 69240V, 69360V, 69480V, 69600V, 69720V, 69840V, 69960V, 70080V, 70200V, 70320V, 70440V, 70560V, 70680V, 70800V, 70920V, 71040V, 71160V, 71280V, 71400V, 71520V, 71640V, 71760V, 71880V, 72000V, 72120V, 72240V, 72360V, 72480V, 72600V, 72720V, 72840V, 72960V, 73080V, 73200V, 73320V, 73440V, 73560V, 73680V, 73800V, 73920V, 74040V, 74160V, 74280V, 74400V, 74520V, 74640V, 74760V, 74880V, 75000V, 75120V, 75240V, 75360V, 75480V, 75600V, 75720V, 75840V, 75960V, 76080V, 76200V, 76320V, 76440V, 76560V, 76680V, 76800V, 76920V, 77040V, 77160V, 77280V, 77400V, 77520V, 77640V, 77760V, 77880V, 78000V, 78120V, 78240V, 78360V, 78480V, 78600V, 78720V, 78840V, 78960V, 79080V, 79200V, 79320V, 79440V, 79560V, 79680V, 79800V, 79920V, 80040V, 80160V, 80280V, 80400V, 80520V, 80640V, 80760V, 80880V, 81000V, 81120V, 81240V, 81360V, 81480V, 81600V, 81720V, 81840V, 81960V, 82080V, 82200V, 82320V, 82440V, 82560V, 82680V, 82800V, 82920V, 83040V, 83160V, 83280V, 83400V, 83520V, 83640V, 83760V, 83880V, 84000V, 84120V, 84240V, 84360V, 84480V, 84600V, 84720V, 84840V, 84960V, 85080V, 85200V, 85320V, 85440V, 85560V, 85680V, 85800V, 85920V, 86040V, 86160V, 86280V, 86400V, 86520V, 86640V, 86760V, 86880V, 87000V, 87120V, 87240V, 87360V, 87480V, 87600V, 87720V, 87840V, 87960V, 88080V, 88200V, 88320V, 88440V, 88560V, 88680V, 88800V, 88920V, 89040V, 89160V, 89280V, 89400V, 89520V, 89640V, 89760V, 89880V, 90000V, 90120V, 90240V, 90360V, 90480V, 90600V, 90720V, 90840V, 90960V, 91080V, 91200V, 91320V, 91440V, 91560V, 91680V, 91800V, 91920V, 92040V, 92160V, 92280V, 92400V, 92520V, 92640V, 92760V, 92880V, 93000V, 93120V, 93240V, 93360V, 93480V, 93600V, 93720V, 93840V, 93960V, 94080V, 94200V, 94320V, 94440V, 94560V, 94680V, 94800V, 94920V, 95040V, 95160V, 95280V, 95400V, 95520V, 95640V, 95760V, 95880V, 96000V, 96120V, 96240V, 96360V, 96480V, 96600V, 96720V, 96840V, 96960V, 97080V, 97200V, 97320V, 97440V, 97560V, 97680V, 97800V, 97920V, 98040V, 98160V, 98280V, 98400V, 98520V, 98640V, 98760V, 98880V, 99000V, 99120V, 99240V, 99360V, 99480V, 99600V, 99720V, 99840V, 99960V, 100080V, 100200V, 100320V, 100440V, 100560V, 100680V, 100800V, 100920V, 101040V, 101160V, 101280V, 101400V, 101520V, 101640V, 101760V, 101880V, 102000V, 102120V, 102240V, 102360V, 102480V, 102600V, 102720V, 102840V, 102960V, 103080V, 103200V, 103320V, 103440V, 103560V, 103680V, 103800V, 103920V, 104040V, 104160V, 104280V, 104400V, 104520V, 104640V, 104760V, 104880V, 105000V, 105120V, 105240V, 105360V, 105480V, 105600V, 105720V, 105840V, 105960V, 106080V, 106200V, 106320V, 106440V, 106560V, 106680V, 106800V, 106920V, 107040V, 107160V, 107280V, 107400V, 107520V, 107640V, 107760V, 107880V, 108000V, 108120V, 108240V, 108360V, 108480V, 108600V, 108720V, 108840V, 108960V, 109080V, 109200V, 109320V, 109440V, 109560V, 109680V, 109800V, 109920V, 110040V, 110160V, 110280V, 110400V, 110520V, 110640V, 110760V, 110880V, 111000V, 111120V, 111240V, 111360V, 111480V, 111600V, 111720V, 111840V, 111960V, 112080V, 112200V, 112320V, 112440V, 112560V, 112680V, 112800V, 112920V, 113040V, 113160V, 113280V, 113400V, 113520V, 113640V, 113760V, 113880V, 114000V, 114120V, 114240V, 114360V, 114480V, 114600V, 114720V, 114840V, 114960V, 115080V, 115200V, 115320V, 115440V, 115560V, 115680V, 115800V, 115920V, 116040V, 116160V, 116280V, 116400V, 116520V, 116640V, 116760V, 116880V, 117000V, 117120V, 117240V, 117360V, 117480V, 117600V, 117720V, 117840V, 117960V, 118080V, 118200V, 118320V, 118440V, 118560V, 118680V, 118800V, 118920V, 119040V, 119160V, 119280V, 119400V, 119520V, 119640V, 119760V, 119880V, 120000V, 120120V, 120240V, 120360V, 120480V, 120600V, 120720V, 120840V, 120960V, 121080V, 121200V, 121320V, 121440V, 121560V, 121680V, 121800V, 121920V, 122040V, 122160V, 122280V, 122400V, 122520V, 122640V, 122760V, 122880V, 123000V, 123120V, 123240V, 123360V, 123480V, 123600V, 123720V, 123840V, 123960V, 124080V, 124200V, 124320V, 124440V, 124560V, 124680V, 124800V, 124920V, 125040V, 125160V, 125280V, 125400V, 125520V, 125640V, 125760V, 125880V, 126000V, 126120V, 126240V, 126360V, 126480V, 126600V, 126720V, 126840V, 126960V, 127080V, 127200V, 127320V, 127440V, 127560V, 127680V, 127800V, 127920V, 128040V, 128160V, 128280V, 128400V, 128520V, 128640V, 128760V, 128880V, 129000V, 129120V, 129240V, 129360V, 129480V, 129600V, 129720V, 129840V, 129960V, 130080V, 130200V, 130320V, 130440V, 130560V, 130680V, 130800V, 130920V, 131040V, 131160V, 131280V, 131400V, 131520V, 131640V, 131760V, 131880V, 132000V, 132120V, 132240V, 132360V, 132480V, 132600V, 132720V, 132840V, 132960V, 133080V, 133200V, 133320V, 133440V, 133560V, 133680V, 133800V, 133920V, 134040V, 134160V, 134280V, 134400V, 134520V, 134640V, 134760V, 134880V, 135000V, 135120V, 135240V, 135360V, 135480V, 135600V, 135720V, 135840V, 135960V, 136080V, 136200V, 136320V, 136440V, 136560V, 136680V, 136800V, 136920V, 137040V, 137160V, 137280V, 137400V, 137520V, 137640V, 137760V, 137880V, 138000V, 138120V, 138240V, 138360V, 138480V, 138600V, 138720V, 138840V, 138960V, 139080V, 139200V, 139320V, 139440V, 139560V, 139680V, 139800V, 139920V, 140040V, 140160V, 140280V, 140400V, 140520V, 140640V, 140760V, 140880V, 141000V, 141120V, 141240V, 141360V, 141480V, 141600V, 141720V, 141840V, 141960V, 142080V, 142200V, 142320V, 142440V, 142560V, 142680V, 142800V, 142920V, 143040V, 143160V, 143280V, 143400V, 143520V, 143640V, 143760V, 143880V, 144000V, 144120V, 144240V, 144360V, 144480V, 144600V, 144720V, 144840V, 144960V, 145080V, 145200V, 145320V, 145440V, 145560V, 145680V, 145800V, 145920V, 146040V, 146160V, 146280V, 146400V, 146520V, 146640V, 146760V, 146880V, 147000V, 147120V, 147240V, 147360V, 147480V, 147600V, 147720V, 147840V, 147960V, 148080V, 148200V, 148320V, 148440V, 148560V, 148680V, 148800V, 148920V, 149040V, 149160V, 149280V, 149400V, 149520V, 149640V, 149760V, 149880V, 150000V, 150120V, 150240V, 150360V, 150480V, 150600V, 150720V, 150840V, 150960V, 151080V, 151200V, 151320V, 151440V, 151560V, 151680V, 151800V, 151920V, 152040V, 152160V, 152280V, 152400V, 152520V, 152640V, 152760V, 152880V, 153000V, 153120V, 153240V, 153360V, 153480V, 153600V, 153720V, 153840V, 153960V, 154080V,



**OFFSHORE AIRBUS**—Going to and from work in Sikorsky S-55s is now routine for crews drifting out with offshore. They have introduced new operating methods offshore. Here, an S-55 nears a tender's landing platform.

## AROUND THE WORLD WITH SIKORSKY HELICOPTERS



**NEWFOUNDLAND PATROL**—This commercial Sikorsky S-55 now regularly patrols Newfoundland's extensive coastal waters, on duty with the Fisheries Department of Canada. Speed, versatility and rugged strength of the big Sikorsky make it an ideal vehicle, especially for work in remote areas where surface travel is difficult.



**NORTH SEA RESCUE**—In mid-January, 54 crewmen from a Norwegian freighter, grounded on the coast of Holland, were rescued by the Royal Dutch Navy helicopter shown above with one of the rescued men. The big Sikorsky, an S-55 Navy version from a Dutch aircraft carrier, made five quick flights to ferry the men to the beach.



### HELICOPTER HISTORY:



America's first world helicopter record—set by Sikorsky's VS-300

**MAY 8, 1931**—Flying his historic VS-300, Igor Sikorsky, nearly 14 years ago, remained in the air for 1 hour 31 minutes 23 seconds, to bring America her first world helicopter record.

The VS-300 was first of the many Sikorsky achievements in advancing helicopter design, development and production.



**SIKORSKY AIRCRAFT**

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## TO JETS

Axelson's service to the aircraft industry extends over a period of many years, and we have seen to it that facilities have kept pace with this fast growing industry.

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**AXELSON Aircraft Division**

AXELSON MANUFACTURING COMPANY

GENERAL OFFICE

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### \* LETTERS

not at all typical of the industry at large. I am proud of the industry in which I have devoted most of my lifetime, and I constantly marvel at the progress that has been made in spite of those who, through ignorance or military personal ambitions, screen leaders against an industry that was born of American ingenuity and which has grown because of American initiative, tenacity, and efficiency.

Apart from letters, indeed. Tell Mr. Morsel to stick to his overrated Ejector seat!

S. C. THORNE  
6014 Second Ave.  
Lagunwood 4, Calif.

## Engineer Shortage

At last you have passed a letter that gets down to facts. I was referring to the letter of William H. Morsel.

For a long time we have been hearing the tale about a shortage of engineers. What absolute drivel!

Inside the great number of engineers being wasted, like Mr. Morsel points out, there are also a number who, like myself, with 15 years experience, have found it more than we can stomach and wouldn't touch it again with a 10 ft. pole.

You, a staff of aircraft engineers would be interesting. I ran more 12 in my moderate circle of acquaintances. But as Mr. Morsel stated, their means for leaving the aircraft industry would not make very good money.

Another thing, but how many of the "left wingers" who peddled in your magazine do you think are sincere? Not too many of them, I can assure you.

Three years ago I was killing time—I haven't the guts to say "sailing"—for an outfit (more or less) that was advertising for aircraft engineers in almost every issue of your periodical.

To all intents and purposes the department had been disbanded three months before. Their next line of attack, reading "sincerely" and "thanking" for the company. The week I signed there was a double-page ad in your magazine calling for engineers. To this day not an engineer has been hired.

Maybe the poor management is the reason for these ineffectual and inefficient advertisements. The last, because an airplane is not an unending product.

S. T. HENNEY  
129 E. Garden St.,  
Tucson, Ariz.

## No Engineer Shortage?

I have read with great interest Mr. Morsel's letter on the "engineer shortage" (AW Nov. 9, p. 12). I too have been accused of not being at the "top" in the wilderness by certain aircraft executives about a short age of engineers.

I recently left a position as an engineer with a large Long Island aircraft manufacturer. I can testify to the waste of engineering manpower by my own experience. For example, in order to obtain a paper from the company library, I was necessary to walk the entire length of the plant (3 miles) be-



Convair F-102A, newly modified interceptor, is a most recent addition to Air Force Supersonic Fleet.



## High Altitude Fuel Flow Failures Eliminated In Convair F-102A!

*Accessory Products Corp. develops emergency by-pass valve for fuel booster pump failures*

See next page ▶

## APCO High Flow Fuel Valves Overcome Danger Of Choked Fuel Supply Should Booster Pump Fail

In the event of a fuel booster pump failure in the Common F 102A, the engine pumps must take over the full load. If however, the fuel wants to be sucked through the dead booster pump, the result would be an excessive pressure loss — too great to sustain engine operation at high altitudes.

✶ To meet this problem, Cooper engineers asked APCO to develop a by-pass valve that would enable an emergency flight even though the boost pump failed. The result is a "T" shaper with light in weight with a high flow line capacity to meet the high altitude requirements. The actual pressure loss in turn is less than if the fuel were to be drawn through the dead boost pump — another example of APCO design ingenuity.

FREE CATALOG  
DESIGNING ABCD SERVICE

APCO has designed and manufactured hundreds of different aircraft pressure regulators, valves and fittings and other components. Send for our free catalog covering many of our developments.



View looking into feed tank showing location of T-Bupper with respect to the stroke pump, but a big space for greater weight saving.

## Couvaire Engineer Credits APCO With Unusual Design Ability

"The 'T' flapper valve for the F102A is a good example of the exceptional design ability of the AP&D engineers," says C. S. Branch, Convair propulsion design specialist. "The valve is light and compact, yet has a high fuel flow capacity — required for high altitude.

"We can totally depend on APCO to do more than just meet the specifications. They have an excellent understanding of our business."



We can usually depend on AFPG to do more than just meet the specifications, even for our 5-10 Branch.

**Meet Everett Badger**  
**APCO Fuel System**  
**Specialist**



APL, C. L. Ford, and the  
operation, E. T. Rudge.



**APCI Fuel Services Specialist, Eric J. Bodger**

To pool all the outstanding ideas coming from our long history in the industry, the APCI Fuel Services specialists, Eric J. Bodger. Only 35 years old yet he has already gained national recognition during his 11 years experience on mission goals and equipment. After graduating from Pace Institute, Bodger spent some time with the Air Force in Alaska making cold weather runs. Currently, he is group head on a special APCI Fuel equipment development

## “Unusual Willingness And Know-How Displayed By APCO” Says Convair Engineer!



<sup>a</sup>We thank APFO's staff members for making (and keeping) this project possible. For more on *Amor Vincit Omnia*, see

"Our thing in particular we like about APCO," says Andy Musella, Sea Ice Design Engineer at Curvco, "is their willingness to make a few parts for us without a promise of a big manufacturing run."

at the University of San Diego, we need good understanding and communication between our engineers and vendors. Because our location is not on the beaten path of the rest of the industry, much time and, in fact, if a supplier does not come up with the answers the first time, APIQ's performance is negatively affected. Also, their constant concern with the weight problems has resulted in some engineering fixes. For example, they have made minor use of spun parts and thin-walled castings. Of course, this means greater weight savings."



Results of our bootstrap tests are in Table 1 (row 10). If MHA values indicate no asymmetry in forecasting errors,

### Time-Saving Single Point Fueling Of Convair Interceptor Made Possible By APCO Vent Valve

During attack, an intruder poses out of gas as its nodes, as an AA without a return. Single-point loading is severe for 1-32 V, since no other instances of loading occur.



ASCO is a 501(c)(3) not-for-profit organization.

This integral fuel tank in the aluminum T-100 can easily be damaged in service due to an overpressure. During the simple point fueling operation, a small amount of fuel valve in each tank is required (3) to prevent an overpressure in case the refueling hose shut-off fails (2) in a place for increased or pressure, as the tanks are being filled. This small sample but more than vent valve, must be dependable at all times. A glaze on this valve could result in a fuel leak being generated for no reason. API's size chosen to design and produce this important valve because of its exceptional organizing ability and performance.



\*Values are rounded off to final year.

**APCO**

**Accessory Products Corp.**

regulatory + active + for functional components  
 engineering design + this document + mechanical parts

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Eastern Engineering Development Corp., 111 Park Ave., New York, N. Y. - *Specialized Service*



## From Wyandotte . . . cleaning products that speed manufacture, cut costs



Wyandotte's South Plant in Pasadena, Calif., cleans fifty-two acres, produces scores of basic chemicals for industry. Here, and at Wyandotte's newest plant in Los Angeles, Calif., specialized products for the aircraft industry are manufactured.

WIDE PROBLEM	ANALYST	DESCRIPTION
1. Airframe cleaning	Aluma <sup>®</sup>	All aircraft, new through work-back cleaning, remove marking, life and oil
2. Descaling aluminum prior to spot welding	SWB <sup>®</sup>	Removes impurities, dissolves residues, controls resistance of aluminum alloys
3. Airframe descaling	WLS <sup>®</sup>	Heavy-duty work cleaner for magnesium, steel, copper and brass
4. Sealing back heat exchanger from aluminum shell, eliminating back-leakage of aluminum	HF Acid	Requires dangerous hydrofluoric acid; easier and safer to handle and use than services
5. Polishing casting	Metab	Prevents cracking. Cuts before heat, dissolves back-skinning. Finish at various sizes
6. Watermark paint from aluminum	Water	Heavy duty abrasive; removes life and aluminum primer, from aircraft surfaces
7. Descaling casting	PJ-1	Heavy duty abrasive for cleaning steel before plating. Dissolves dirt, scale, and to water to prevent building for subsequent finish. Removes light burns.
8. Rust treating	Barnes	Acid phosphate floor treatment; makes floor slip-resistant, safe on treated steel
9. Rust abatement (airfield)	Duralite	Acid phosphate floor treatment; makes floor slip-resistant, safe on treated steel

Circle 10 on Reader Service Card

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### LETTERS

at the present and last year. Civil Service pay bill is going through the house and to the President, because of the postal workers and we are on the verge of the dual shadow of a vote hanging over our heads because Congress will not vote an increase in postal rates.

Nancy Winemaster

### AGCA Problems

The automatic ground control apparatus referred to by Donald Graham and Herbert Lehman (AFR Pilot Captain, Feb. 21, p. 11) do not use the experimental AGCA equipment which is being tested at Wright Air Development Center.

However, these problems have been discussed in the production AGCA equipment (approved by Federal Air Development Center), which is now in pilot run production at Cadillac Fair Inc. Models of this production equipment have been functioning at the Cadillac Fair, and at Fort Worth, Calif., for more than a year with no evidence of cause such as the symptoms and slow down control signals, this is primarily due to the use of a different instrument system.

In addition, the new equipment also notes the rate speed on the approach area in which rate data may contain significant measurement. The AGCA computer system has been optimized such that rate data is rejected throughout the approach area. These measurements combine to more smooth and accurate AGCA approaches.

E. C. Cress  
Project Engineer  
Gulfstream Brothers, Inc.  
3315 Venice Boulevard  
Los Angeles 4, Calif.

### B-Hr. Work Limit

In reading the Jan. 11 Airman's View, I find that the ALPA and one of its members do not agree, that I find Robert.

Pilot Robert says that a man will get tired from working and I agree, ALPA also took the stand and found a strike against American Airlines because they didn't agree with the CAB that an extra 30 min. was a safe procedure.

Then I find in the same issue that they aren't tired anymore and that it's preferable to operate an aircraft working over it, being, providing they have more safety in their pocket, since a lot of it is that the extra money will provide the fatigue and thereby make the flight safe.

Actually the article said against the CAB and not American Airlines, therefore I believe it's about what ALPA suggested trying to run the airlines and airline industry and just operate as it is suggested is—that is in the beginning, after the pilot, and the operating unit for all airlines. In other words I believe that the CAB should be in charge and control airlines and safety procedures.

Would like to see Pilot Robert's article stay closer to facts and not as much imagination—domestic operations of 14 to 16 hrs per day on duty and so forth.

A. W. Zimm  
4111 Brentford  
San Diego, Calif.



## SPINS LIKE "BLAZES"— so Radiography checks each one



Radiograph of all scavenger rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the maker's shrewd expression for the rate at which the rotor spins. Fast, it spins so high that the soundness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving machines with x-rays has become common practice with more and more suppliers of quality castings. They know it helps build reputation for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography as a Foundry Tool."

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X-ray Division  
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## Radiography...

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larity of RTT transmission at UHF frequencies at distances of at least 400 mi.

The phenomenon shows some of the characteristics of ionospheric reflection, but these appear to be other factors involved. This has caused the widespread term of "scatter" to be abandoned in some quarters for the term "forward scatter." The phenomenon is sometimes likened to a powerful searchlight aimed at the sky, some of whose light is reflected to the ground by the atmosphere.

► **Q&A: How bested—**Continuity to certain views on tropospheric propagation, Kenneth Hollings of Bell Telephone Labs told the IRE that:

• **Critical headwinds** can be achieved in RTT transmission, which are at least 10% of those obtained in line-of-sight (LOS) transmission, using the same size antenna.

• **Antenna gains of 40 db.** can be achieved in RTT transmission, with a loss of only 2.2 db from that obtained with LOS. Not too long ago scientists believed that maximum antenna gain was limited to 16-15 db. under RTT conditions because of phase shift, Bell Labs says.

A series of experimental broadcast tests of commercial TV video and sound over a distance of 188 mi. was shown by Bell Labs' W. H. Todd. (The

**Tropospheric Propagation Booklet**

New brochure prepared by National Bureau of Standards describes tropospheric propagation experiments, theories, and facilities at NBS's Central Radio Propagation Lab near Cheyenne Mountain in Colorado. The 39-page publication, authored by A. P. Bass, J. W. Borchert, and K. D. Blandhop, is classified as NBS Circular 594.

It is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 50 cents per copy.

video signal was frequency modulated on a 5,000 mc. carrier). Return quality was excellent, with satisfactory fades occurring every 15-20 seconds. These were noticeable but at best as not to be unduly bothersome in the movie.

Another example of over long-range tropospheric propagation was described and demonstrated by Walter Morrow of MIT's Lincoln Lab. In a post Lincoln Bell Labs investigation, a 400-mc. voice signal was successfully transmitted over a 375 mi. path with relatively little fading or interference. A 24-1 db. antenna and 5 kw. transmitter were used at least 1,000 times

the power employed in present transcontinental line-of-sight microwave networks.

Tropospheric propagation, said to occur under ionospheric, is subject to fast fading, control by multi-path transmission, as well as slower fading over a period of hours or days, which is independent of frequency. One possible solution to this problem is the use of several antenna locations (diversity antennas).

► **Tropospheric vs. Ionospheric—**There are interesting differences between the RTT characteristics of tropospheric and ionospheric propagation, Hollings pointed out.

For instance, attenuation losses are essentially independent of radio frequency when the waves are "scattered" from the troposphere. However, attenuation goes up sharply with frequency when ionospheric propagation is involved.

For instance, in tropospheric propagation, 100 mi. beyond LOS range a 100-mc. signal is down approximately 90 db. over tropospheric attenuation. The frequency can be increased 10-fold to 1,000 mc., with less than a 2.0 increase in losses (57 db.) according to Hollings' figures. In contrast ionospheric attenuation is more than tripled over two-space values when the frequency is raised from 15 mc. to 50

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mc. (55 db to 95 db).

One theory advanced to explain the frequency sensitivity of ionospheric propagation is that the ionospheric layer is not solid, but made of a series of "columns" or "cells" in the wavelength of the radio signal is large compared to the holes, the earth acts like a solid layer and reflects the signal. At higher frequencies, where the wavelength approaches or becomes smaller than the mesh holes, waves pass or through without being reflected.

► **Experts Disagree**—The National Bureau of Standards and Collins Radio have conducted experiments 1,100-mi. transmission of an unmodulated 50-mc. carrier between Collins Rapids, Iowa, and Sterling, W. Va., using ionospheric propagation. These tests indicate the following characteristics for RTH ionospheric transmission, NBS's Dana Bailey reported:

► **Strongest signal reception occurs in the summer.**

► **Signal strength in December during mid-day is nearly as high as peak signal during the summer, but falls off sharply with distance.**

► **Signal strength in the Arctic during the summer is much higher than at lower latitudes, and does not drop off so sharply.**

► **Strong enhancement of a 50-mc. signal has been observed in the Arctic during intense magnetic activity which blocks out normal HF radio signals.**

Bailey's conclusion is that ionospheric RTH propagation appears to show a dependence upon solar activity, possibly due to ionization scattering directly or indirectly from the sun's rays.

Dr. Gerald Villard, of Stanford University, took sharp issue with this explanation. Villard's theory is that ionization caused by cosmic rays plays a dominant role in ionospheric reflection. He presented limited data which indicates that propagation is best at times of intense cosmic showers.

► **AF Puts to Use**—The Air Force presently is operating a three-day latitude network (non-channel) between Laramie, Wyo., and Thule AFB in Greenland, employing RTH ionospheric transmission, Bailey reported.

The network operates across the arctic zone, where ordinary HF communications are usable only 68-70% of the time. In contrast, the new RTH ionospheric transmissions have demonstrated a reliability considerably better than 90% over the two northern links, and 93-95% over the southern link (Laramie to Goose Bay), Bailey reported.

The reason for the poorer showing in the southern link is that the hop distance is too short. RTH ionospheric transmission operates best at distance of 600 to 1,200 mi., Bailey said.

► **Propagation Characteristics** — NBS

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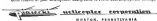
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Both of Alcoa's forge shops are equipped with the ultrasonic inspection device pictured below. The apparatus, by tracking the forging under water with reflected ultrasonic waves, can instantly detect any discontinuity inside the forging. By probing far deeper than is possible with other nondestructive methods, it enables forging specialists to spot hidden flaws hitherto impossible to locate. Alcoa has been using ultrasonic inspection testing for 10 years and now has 30 units in operation.

This is just one of the advanced methods Alcoa uses to control the quality of forgings, castings, sheet and other products supplied to the aircraft industry. Alcoa pioneered many of these methods—and continues to do so. The Alcoa Cleveland Research Laboratory, for example, is experimenting with the first prototype stereoscopy unit—a device that yields an X-ray image in just 45 seconds.

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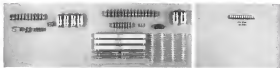
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Spectrometers, pioneered by Alcoa, have been installed in all Alcoa foundries, forging and casting plants to ensure the aluminum is quality control. Over eight million quality control determinations are made each year on these spectroscopic measurements. Of these, over 500,000 are metal composition determinations. A sample is taken from every ladle, an analysis is made by the spectrometer and the results are sent back to the melting room before the shipment is poured. No other company has made as extensive use of such analytical instrumentation.



Electric conductivity testers are used in Alcoa plants to test for proper heat treating. Any soft zones in the metal, resulting from incomplete quenching, are instantly detected by the device. Men at Alcoa development center demonstrate the meter.



VACUUM-TUBE CIRCUIT (EQUIVALENT WITH APPROXIMATE TYPE)	DIODE AND VACUUM-TUBE CIRCUIT (EQUIVALENT WITH APPROXIMATE TYPE)	PHILO TRANSISTOR CIRCUIT (EQUIVALENT WITH APPROXIMATE TYPE)
POWER REQUIREMENTS 21.5 WATTS	POWER REQUIREMENTS 26.6 WATTS	POWER REQUIREMENTS 0.036 WATTS

**TRANSISTORIZED COMPUTER CIRCUITS** designed by Philco greatly reduce circuit complexity of conventional tube and tube-diode circuits, and shrink number of components and power required. Circuits use only transistors and resistors.

studies suggest that signal intensity of B118 spectroscopic transmission varies approximately as the sixth power of the angle of incidence between radio beam and the isophanes. Bailey said (The angle of incidence increases with distance between two-point points).

NBS tests also indicate that signal intensity varies inversely with the fifth to seventh power of the radio frequency. The B118 power figure is best for radio frequencies of 27 to 40 mc. The seventh power is the range of 40 to 107 mc, Bailey reported.

Experiment with the AF's subminiature circuit, he said, indicates that type antenna provided better performance than the earlier and standard type. A new four-way Yagi type also "looks good," Bailey said. The antenna employed are quite large, requiring considerable "local capacity" and this using a quite critical, Bailey noted.

## Transistorized Computer

By applying certain exclusive new ideas of transistor to the design of digital computer circuitry, based on merely substituting them in conventional vacuum-tube computer circuits, designers can save considerable circuit

complexity, number of components, and reduce power consumption, Philco's Ralph H. Brown told the IRE. (The paper was coauthored by Philco's Ralph H. Brown and William E. Bradley, with Morris Rabinowitz of the University of Pennsylvania.)

▶ **Transistor Computer**—Brown described the transistorized authentic action of a Philco digital computer called Transic (TRANSISTORIZED AUTOMATIC COMPUTER).

The entire arithmetic unit consumes only 54 w at 7 v, and consumes only a 54-w tube. It runs no fan, delay time is 100 nsec, and its maximum-only 1,242 vacuum barrier transistors and 322 resistors.

Working with 19 binary digit numbers, the unit can add or subtract in 2.6 microseconds, multiply or divide in 46 microseconds, and shift in 3.4 microseconds.

▶ **Simplified Computer Circuits**—Specific examples of component economy of Philco-developed transistor circuits are comparable tube and tube-diode circuits include:

▶ **Flip-flop (Dodeca-junction)** shown by Brown uses two tubes, two capacitors, four diodes, one resistor, and consumes 15.4 w. A comparable tube-diode flip-flop circuit employs one tube, one delay line, 19 diodes, one transformer, and consumes 8.25 w, according to Brown.

▶ **Clocked "latch-or" pulsed circuit** employs one transistor and three resistors, consuming only 6.627 w. The comparable vacuum tube circuit used by Brown uses two tubes and 23 resistors, and consumes 23.5 w. The diode-tube version employs two tubes, one transformer, 18 resistors, and 25 diodes, consumes 10.4 w.

▶ **Binary adder circuit** uses 13 transistors and four resistors, consumes 4.36 w. Tube equivalent uses four tubes, one capacitor, 11 resistors, and consumes 21.7 w. Diode-tube version uses two tubes, 26 resistors, 32 diodes, one delay line, and consumes 25.5 w, Brown said.

## New Techniques

Coffin Radio has achieved a 40% reduction in the total number of components employed in its new mobile AN/VRC-34 VHF/UHF transmitter.



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recently compared to older vacuum 1,800-ohm 100W unit now used by USAF and Navy, according to Paul Wolkoff, by using "model reflect test ranges."

The new VRC-24, developed under Signal Corps sponsorship for ground-to-air launch use, employs 39 tubes of five different types. This compares with 39 tubes of 21 different types in the ARC-14. Wolkoff told the IRE convention.

Model VRC-24 model has conservative service test rating of 2-w output, compared to ARC-14's 5-w rating, but a new version of VRC-24 will be rated at 10-w, without an increase in size or weight, he said.

Collins has achieved this significant reduction in tubes and components by designing the VRC-24 so that all tubes and tuned RF circuits are used both as the transmit and receive modes, except for the power amplifier, its plate circuit, and the receiver third intermediate amplifier.

Techniques Widely Applicable—The techniques employed generally are applicable to any complex type of multi-channel vacuum transmitter operating at or below the same 220-600 mc frequency range, Wolkoff said. This includes both the direct frequency modulated type circuit employed in the VRC-24, and the indirect type employing crystal stabilized variable-frequency modulator.

Refueling is accomplished with a maximum of only frequency modulating and intermediate frequency amplifier are switched by means of dual motor circuits whose plate voltages are controlled through relays. Interlocking byproduct of the relay design, according to Wolkoff, is that VRC-24 receiver section can be aligned without the use of an external signal generator.

Power Non-Aid Diode—[also, a construction wave phase-comparison system, which reportedly is capable of establishing accurate position to an accuracy of 0.5 ft, was described by Donald H. Jacobs, head of Jacobs Instrument Co., developer of the system. It consists of a master ground station

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plus two slave stations, spaced 30 to 40 mi apart.

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The result is that different carriers, each modulated by the same basic five frequencies, each transmitted from one of the three ground stations.

►These Airborne Receiver-Nodes—in the search, individual sections are used to demodulate the three carriers, after which filters resolve the modulations into the five individual frequencies.

A phase comparison between  $f_1$  (the lowest frequency) obtained from the master and one slave station gives one hypobolic coordinate, a similar comparison between the master and the other slave gives a second. These two coordinates establish airplane position.

If  $f_1$  has a wavelength of 360 m, a phase comparison accurate to 1 deg resolves airplane position to approximately 1 m. Phase comparison of  $f_2$  (second) the wavelength of 12 m establishes airplane position to within approximately 0.1 m, and according phase comparisons of  $f_3$ ,  $f_4$ , and  $f_5$  resolve position down to 0.5 ft, Jacobs says.

Phase comparisons are made automatically and displayed in alphanumeric style on a cluster of five small cathode ray tubes. Military secrecy prevented the release of more details, Jacobs said, but he indicated that the carrier frequencies had line-of-sight characteristics.

►Hughes Typotrons—By incorporating a storage-tube feature in its Typotrons, Hughes is able to eliminate the need for intermediate storage devices required by the Cramo Characterizer. The RUC tube was developed by R. M. Smith, and was employed in HMC's JBE vehicle.

The Typotrons can display any one or combination of 65 different characters on its 5-in. face, holding them indefinitely until erased or erased. Reading speeds of 25,000 characters per second are possible with the tube, Smith reported.

Like conventional storage tubes, the Typotrons employs a storage target upon which the electron beam, shaped to the appropriate character by a read matrix, writes.

A separate electron flood gun transfers the character from the storage target to the tube's front phosphor face where it is displayed. The displayed characters are 4 in. high.



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## New Computers Use More Transistors

Completely transistorized digital computers, approximately one-half the size of vacuum tube models and consuming only one-tenth as much power, will be commercially available from International Business Machines Corp. early next year.

The new IBM-608 will use more than 5,000 transistors. These dimensional arrays of magnetic cores will be used for internal machine storage and input-output will be by punch cards. The new machine reportedly will have a computing speed that is 21 times that of IBM's Type 607 (vacuum tube) calculator. The 608 will be able to multiply two 9 digit numbers in 11 microseconds, divide in 13 microseconds. Machine rentals can be purchased out on the road at the rate of 135 cents, approximately 50% higher than the Type 607.

Other recent computer developments of interest in the aviation field include:

• **Lockheed Aircraft Group's Division** recently has put the IBM Type 450 magnetic drum calculator to work at its Marietta facility. Company's Missile Systems Division also is using a Type 650, one of the first models shipped by IBM. Machines will be built for missile system studies and company growth.

A second IBM 650 is slated to go to Lockheed's missile group in May.

• **White Sands Proving Ground** recently has installed a Princeton Rand Unesco Scientific computer developed by the firm's Engineering Research Associates Division.

Known as the ERA 1003 when first manufactured several years ago, the Unesco Scientific will be used to spend millions of missile flight test data, and is expected to handle computations for as many as 10 missile firings a day.



### Trial by Cold

This picture was taken at —GIF during six tests of SM-64 rocket, launched on transportable GCA, at Ladd AFB, Alaska, by USAF. After the cold-weather tests, the equipment was flown back to Eglin AFB, Fla., where it had previously undergone extensive testing. SM-64 is manufactured by Laboratory for Electronics, Inc., Boston.

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## New Marconi ASR Eliminates 'Clutter'

A new British low-frequency, long range surveillance radar, whose operation is the 50-cm. region reportedly makes it "virtually unaffected" by precipitation, will be unveiled soon at London Airport. U.S. long-range ASRs, which operate on 10 cm, are bothered by precipitation unless equipped with circular polarizations.

The radar, designed and manufactured by Marconi's Wireless Telegraph Co., Ltd., will serve the Southern Air Traffic Control Center. It is priced at \$70,000.

The new S212 set employs crystal controlled and an extremely efficient MTI (moving target radar) system to eliminate unwanted clutter from third ground obstacles. This enables set to be used simultaneously for both long range surveillance (to more than 100 miles) and close-in approach control

(down to 1 mile) when separate Plan Position Indicators are installed, Marconi says. Up to eight PPIs can be used.

► **Technical Highlights**—Significant technical characteristics of the new Marconi radar include:

- Airborne wave continuous rotation in either direction at speeds of 4 to 30 rpm, or a reciprocating cycle over an arc of 10 to 80 degrees either side of a preselected bearing, at speeds of 1/17 to 24 rpm.
- Peak power: 50.00 kw
- Azimuth: beamwidth: 35 degrees at half power points
- Vertical coverage: Approximately 20 degrees
- Full adjustments: -1 to +10 degrees
- Pulse length: 2 to 4 microseconds
- Pulse repetition rate: 500 to 800 pps
- MTI suppression: At least 40 db, to maximum radar range

The new S212 will replace an early developmental model which has been used at London for some time.



## Sperry Tests Robot Intercept System

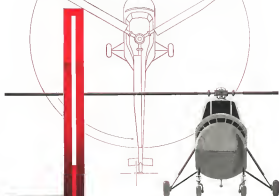
Remote-control interception of enemy bombers is not possible so far, says Sperry system for radio guidance of jet fighters from ground to "mother ship" base stations.

Another use is for ground-based intercept, such as missile tests.

In new system, drone is not downed by loss of UHF guidance signals, as in most radio remote control systems. A device in the drone automatically takes control when signals are lost for five seconds or more. If plane is below a predetermined altitude, it is put automatically into a full power climb, over 400 ft/min. If signals are restored, and if a preselected approach, the craft goes into a climbing turn until it reaches a safe altitude. At this point, altitude control automatically engages, and the plane flies a left-turning orbit until radio guidance is restored.

The new system is a standardized production version of an earlier model developed by Sperry Gyroscope Co., Great Neck, N.Y. Other new features include automatic control to the remotely controlled landing system, provision of intercepting information from drone to the ground or mother ship, plus completed preflight maintenance and checkout.

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WHEN SECONDS MEAN SURVIVAL, ground support equipment of unsurpassable reliability is the indispensable factor. As a pioneer in all phases of ground support, CONSOLIDATED has developed units of broad application for maintaining readiness or plotted aircraft at a constant ready. Through design, development and manufacture, we have solved the most complex problems of providing self-propelled, multi-purpose units... for towing, testing, servicing and storing guided missiles and jet aircraft... quickly, safely and under the most difficult operational conditions. Several of CONSOLIDATED's models are now being used extensively by the U. S. Air Force, Navy and Marines.

MODEL 2100 INCORPORATES HYDRAULIC, A. C., D. C., ELECTRIC, AND TOWING.

IN THE DYNAMIC FIELD OF GROUND SUPPORT EQUIPMENT AND DEMONSTRATED ITS ABILITY TO MEET THE MOST COMPLEX DEMANDS



**CONSOLIDATED**  
DIESEL ELECTRIC CORPORATION

STARFORD CORP. BRANCHES: DALLAS TEX. FORT WORTH TEX. SAN ANTONIO TEX. WASHINGTON D. C.



Model 2100

### GROUND SUPPORT

The compact self-propelled multi-purpose unit Model 2100 performs all requirements of electrical, hydraulic, and pneumatic testing and servicing of guided missiles. Self-use, ideal for heavy duty towing. It provides:

- HYDRAULICS... 18 gpm, 2000 psi variable volume pressure (temperature)
- A.C. POWER... 20 KW, 480 volts, 3 phase, 60 Hz (with phase shift control)
- D.C. POWER... 24 volts, 500 amp on demand
- TOWING... All wheel drive, rear SWS (to tow trailer)

Other models of single and multi-purpose ground support equipment are available with hydraulic systems... only combination of A.C. and D.C. power... high and low pressure pneumatic systems... refrigeration and heating.



**CONSOLIDATED**  
DIESEL ELECTRIC CORP.

STARFORD CORP.  
10000 E. 10th Ave., Suite 100, Denver, CO 80231

AVIATION WEEK April 12 1955

also seems to reflect better its diversified activities, particularly in the aviation field, which up to 1953, 1954 and 1955, approximately 15% under the previous year.

Despite this, profit before taxes reached \$1,503,513, up 5% over 1953, while profit after taxes totaled \$1,414,513, an increase of 24%. Net profit per share was \$2.05, a 24% increase over 1953. The \$1 dividend was the same as in the previous year.

Hobbs's stock was listed for the first time on the New York Stock Exchange beginning Jan. 10, 1955. Gross paid-up capital was increased last year by approximately \$475 million as the result of a 15-year loan from the Victor Reppert Life Insurance Co. Airborne radar receivers and Navy-deployed radio transmitters, two of Hobbs's Laboratories' largest military production contracts, are expected to be in full-scale production in mid-year, the report states.

Corporate eyes it has achieved "an outstanding reputation in some radar test techniques" and that its patented Hobbs-Incremental Suppression, "most advanced unit developed in the field of some industry" has been licensed to several other firms for manufacturing and sale.

### FILTER CENTER

• **Timberline Plant up for Sale—Original Project:** Timberline plant in Alameda, Calif., which has been operated for 10 years by Wilson-McKee Electronics Division, soon will be put up for sale or lease to a firm in the electronics industry, it is reported.

• **Bell Paces Breakthrough Navigation—Bell Aircraft Co.** is advertising widely for experienced engineers for special assignment duties work, an indication of growing activity and progress in this field.

• **Automatic Synthesizer Scheduled:** Stanford Research Institute and USAF jointly will sponsor the second of three annual symposiums on automatic production of electronic equipment, Aug. 22-23 in San Francisco. The SRI USAF symposium will discuss with Western, which will be held Aug. 24-25 in the same city.

• **New Decca Chain—The Swedish geodesy will install a new Decca navigation chain of ground stations on Gotland in Stockholm.**

• **Bright Idea Needle-Use military:** used currently only for solution is a moving target indicator (MTI) for use in flying pilot ships which will be

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**A Key Component of a Complete System**  
**Close Coordination For Pneumatic Power**

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Components include: 1. 1/2" to 2" O.D. valves, 2. 1/2" to 2" O.D. solenoids, 3. 1/2" to 2" O.D. check valves, 4. 1/2" to 2" O.D. pressure indicators, 5. 1/2" to 2" O.D. solenoids, 6. 1/2" to 2" O.D. check valves, 7. 1/2" to 2" O.D. pressure indicators, 8. 1/2" to 2" O.D. solenoids, 9. 1/2" to 2" O.D. check valves, 10. 1/2" to 2" O.D. pressure indicators.

"sensitive" to movement of target aircraft, but "insensitive" to movements of the airborne radar itself, should the pilot.

► **NEC Proceedings Available**—"Proceedings of the National Electronics Conference" of 1974, containing 46 technical papers totaling 872 pages, is now available in bound form. Price is \$5.00. Copies may be obtained from NEC at 84 E. Randolph St., Chicago 1.

► **Computer Summer School**—University of Michigan will conduct an intensive summer session course in digital computers and data processing for engineers, mathematicians, and managers next August. University will offer both general background courses in computers, programming, and application, as well as specialized programs in computer engineering and logical design. Further information is available from Dr. John W. Cox III, Digital Computer Center, University of Michigan, Ypsilanti, Mich.

► **Relay Conference Report**—A 70-page brochure, containing 13 technical papers presented at the Third National Conference on Electromagnetic Relays (held Mar. 9-11 at Oklahoma A&M College), is now available from Patton & Brunsfield Manufacturing Co., Princeton, Ind., a subsidiary of American Machine & Foundry Co. Requests for copy should be made on company letterhead.



### Simplifies Tuning

A lightweight pilot can test or control two frequency units only if he continuously "tunes" receivers in sequence with a new VHF collector. When pilot selects desired frequency, collector emits low-power modulated signal to which receiver can be tuned by ear. Collector tunes alone, made by Earl W. Springer, Aurora Radio Co., Box 150, Indianapolis, Ind., is priced at \$67.75 with three crystals, \$173.75 with 26 crystals. Frictionlessly smooth unit, called SelectoTune, is made by Mox-Sig Communications, P. O. Box 515, Melrose, Ore.



## STRATOS

### AIR-CONDITIONS THE NEWEST USAF BOMBER THE EIGHT-JET BOEING B-52

The Boeing B-52 jet bomber entering operational service with the Strategic Air Command this spring becomes the world's first heavy jet bomber to go into service.

Joining the medium jet bomber segment to SAC—the Boeing B-47—the B-52 "Stratofortress" greatly outperforms America's Air Arm. A high speed, high speed heavyweight with a range longer than that of any other operational jet aircraft, it is destined to be the backbone of SAC's striking force for some time to come.

To cool the crew and the tons of electronic equipment aboard the B-52, Boeing picked a highly efficient cooling system designed and produced by Simco.



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## Ejection Seat Design: Two Approaches

By George L. Christian

Two new ejection seats developed for high-speed military aircraft show two different approaches to seat design.

• **Republic Aviation Corp.** seat for the F-105 and RF-105F was built with emphasis on standardization and adaptability to many aircraft.

• **Chance Vought Aircraft** seat for the F7U-3 emphasizes weight reduction without compromising pilot safety. It is based on concepts developed by Douglas Aircraft Co. for the A1D Skyhawk (AV Jan. 14, p. 30).

The Republic Air Force seat incorporates protective leg braces, the Chance Vought Navy seat does not. CVA seat survey figures show that 28% of pilots using ejection seats in over 700 battles since World War II forget or fail to use the straps.

Another discrepancy is in ejection procedure. The Republic seat requires the pilot to raise leg braces and squeeze a trigger, which can be done in rapid succession so with a delay between motions and with either hand. The Chance Vought seat uses the familiar type of trigger motion.

Design of the 60-lb Republic seat was based on "an analysis of latest and anticipated escape system requirements as established by the Special Projects Branch of USAF's Aircraft Laboratory at Wright Air Development Center."

The CVA seat weighs 30 lb., mounted in 138 lb. of previous seats installed in the company's F7U-3. An other company working now on ejection seat projects is the Stanley Jara Iron Corp.

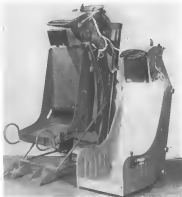
• **Republic Seat.** Here are some relative merits in the Republic seat:

• **Seat back frame.** is a separate sub-assembly, making it easy to adapt the basic seat to various aircraft having open pitcock cockpit layouts.

• **Structural rigidity.** allows the seat to be ejected at maximum speeds of the latest aircraft, ranging into the supersonic. This feature also reduces the danger of the seat "snapping the tracks" during high deceleration braking accidents.

• **Use of multi-purpose components.** straightforward design, and simplified construction increases probability of excellent installation. Because it is adaptable to many aircraft, even smaller two of the seat may be possible, along with simplified inventory and logistics problems.

• **Ejection Procedure.** Pre-ejection pro-



**NEW EJECTION SEAT** (right) for C-119 is 100 lb., lighter than old (left).



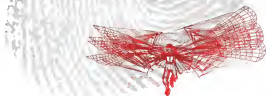
**REPUBLIC SEAT** fits 60 ejection aircraft. Normal position (L), ejection (R).



cedure requires pilot to raise protective leg braces, this lifts the seat up, locks the shoulder harness, jettisons the canopy, sets the outboard trigger, de-

compresses the ejection and moves gun-  
right and the control column out of  
the way.  
Ejection is accomplished by squeeze

## THE INDELIBLE IMPRINT OF SKILLED HANDS



## NEW ROYAL JET WING TANK DESIGN CUTS ASSEMBLY TIME TO 13 MAN MINUTES

The moment man became airborne the race began to advance the science of flight. The skilled hands and productive minds of an imaginative industry have kept America in the lead. The skilled hands of Royal Jet specialized production engineers help to maintain the pace with new production techniques.

**EXAMPLE:** Royal Jet, the first, and today only producer of hi-roasting fast tanks has perfected a new joint design to speed assembly. 2 men can now completely assemble a 450 gallon, hi-boost ratio tank in 13 man minutes. Formerly, assembly required a full 145 man hours.



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ask Albert Swartz...

ask Joan V. Tesch...

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Joan V. Tesch, possibly the only lady "crop duster," says: "I've flown the bus 8 years with Gulf products. There aren't any aviation products better for our specialized type of flying."



Albert Swartz says: "I've been an exclusive user of Gulf Aviation Products for the last 4 years. I consider Gulf Aviation Gasoline and Gulf Oil as real insurance against engine trouble."



For safer flying, get acquainted with...



**Gulf Aircraft Engine Oil, Series-R**  
For radial engines, or where a detergent oil is not desired. Approved by Pratt and Whitney and other radial engine manufacturers for all types of service. Retards sludge and carbon formation and retards oil hardening at high operating temperatures.



**Gulf Aircraft Oil, Series-D**  
For horizontally opposed and Ranger inline engines. Minimum ring and valve sticking, no consumption, oil-saver slugging and plug fouling. These oil that great designers all have found periods between engine overhauls as long as 100%.



**Gulf Aircraft Gasoline**  
It's "refinery-clean" for your safety because Gulf Aircraft Gasoline dispensing units are equipped with advanced moisture filters.

Joan Tesch and Albert Swartz, co-owners of the Sky-Way Crop Dusting Co., stand with one of their crop dusting fleets.

ing a trigger. This blows out and accept, disconnects oxygen and electrical connection and engages a heat delay device to release the seat in two seconds when the pilot is at the height of his arc, away from the aircraft.

Safety devices prevent inadvertent operation of projection and ejection mechanisms.

Minimum possible guided stroke for emergency ejection mechanism has been assured by use of efficiently installed slide blocks, Repobell says. In the F-34F and RF-34F, there is 15% increase of minimum guided stroke with out structural changes in landing gear or cockpit, according to the manufacturer.

Repobell has a patent pending and has formed Aerojet Motors, Inc., Colorado Springs, Colo., to manufacture and sell the seat. It also will be offered to NATO air forces through Repobell Aviation International S.A., Lugano, Switzerland.

Choice Vought Star-Wright using of the CVA seat was achieved by eliminating such items as the stabilizing doggie parachute, seat adjustments for tilting and forward backward movement, pneumatic controls, and the leg bracket and foot straps, as in the Douglas A-10 seat.

The pilot still can adjust the seat for height along the seat's tilted axis.

Problems—Since there is no pneumatic handle for pilot merely pulls the lever control down to open himself.

During the first part of the seat's travel it locks the pilot's shoulder and hip harness automatically, releases the canopy and ejection seat and pilot using the Navy 200 series as pattern. If the ejection harness disengagement mechanism fails the pilot can free himself from the seat by using a handle on its side.

The Choice Vought seat, like the Douglas A-10 seat, follows much of the simplicity found in German jet and rocket plane ejection seats and in the final phase of World War II.



MEMO FROM KAWNEER

SURELY, New cockpit enclosure contracts with Kawaner pay 377 L. QUALITY, ECONOMY, DELIVERY

Get into

When you accept contracts for cockpit enclosures, you are also accepting a KAWNEER ENGINEERING SPECIALIST, such as Kawaner, who can offer a "one-stop" package. This package includes engineering, design, tooling, and production which are important advantages available to you by using integrated Kawaner facilities.

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3. You receive the economical advantages of having both the transparent plastic, glass, and metal work handled by one supplier.
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5. Your changes and improvements can be handled in the most economical manner because all facilities are under one roof.
6. You receive, because of all these integrated facilities, a complete unit which only needs attaching to the fuselage.

As specialists, Kawaner continues to work on the overall improvement of the product by integrating new engineering ideas and materials into the operation.

Write today.  
Aircraft Products Division

## 377 Vs. 707

Superiority of a jet transport's cockpit is underlined by these Boeing specs, comparing the company's piston-engine Model 377 Stratoliner and its jet Model 707 Stratoliner.

Number of display instruments bearing light, instrument gauges, dials have been added 49%, from 155 to 236, while number of controls have been cut 44%, from 170 to 105.

As Boeing puts it: "Cockpit complexity of the four jet, 518 sq. ft. is 40% more comparable to the two-engine, 175 sq. ft. DC-3."



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## Ryan Electronics "Guides" U.S. Airpower



Using unique continuous wave radar techniques, Ryan has created new flight hybrid sources of basic intelligence for planes, missiles, helicopters and light-than-air craft. This electronic intelligence capability Ryan's new automatic navigational—a completely self-contained system which can navigate aircraft in any point on earth. This same intelligence can make anti-aircraft operations in hyperspace maneuvers—sending them to search out and hit elusive and elusive targets. It can be used to develop superior systems for bombing, aerial photography, intelligence gathering and anti-aircraft warfare. Ryan electronic systems—simple to operate, need less maintenance, faster adjustments.

### Another Example of How

## RYAN BUILDS BETTER

Recognized as a leader in electronics, Ryan has the skilled personnel and experience to meet the most complex navigation and guidance requirements. Recognized with the manufacturing radar equipment for the first anti-air missile—the Ryan Firebird of 1946—Ryan has consistently solved the "can't be done" problems. Ryan is also pioneering in the development and manufacture of power plant equipment and accessories, including afterburners and other

components for jet engines, complete rocket motors for missiles, and vehicles of advanced aerodynamic design. Among the achievements resulting from this engineering effort are Ryan's new jet-powered VTOL aircraft, new building, and the Firebee drone missile. Because Ryan markets all three elements of flight research and development—power plants, aircraft and electronics—it is uniquely equipped to solve the toughest problems of modern flight.



**PORTABLE TRAINER** comes to action, is easily set up in a few minutes.

### 'Capsule' to Teach How to Eject

**Buffalo**—An ejection seat "capsule trainer" that can be carried by two men and contains everything needed for ejection instructions is being built by Cessody Corp. USAF has ordered 41, at a price of \$680 each.

The trainer measures 10x10x20 in. and weighs 125 lb. The capsule contains all the information charts, "do's" and "don'ts," working models of seat and ejection mechanisms, and other components in an easily transportable package that can be set up quickly for pilot instruction.

Being inexpensive, large numbers of capsule-type trainers can be provided. Cessody says, not only at training headquarters, but at operating bases where they can serve as refresher training devices.

Being self-contained and not requiring any power supply, the trainers can be set up anywhere—in the hangar, on a road, near or in the room. The trainers can be opened and closed for business by two men in minutes. Various eas-

ures as a table on which the instructor places the device instructions and

Overseas, three-dimensional, two-man portable trainers to simulate the actual operation of all working gear associated with the ejection mechanism. Among these is a panel which shows how the seat is automatically released from the pilot's body, after ejection (when he is at the peak of his ejection trajectory). Also included is a panel demonstrating the automatic parachute opening device.

A full-scale working model of an ejection seat, complete with ejection cord, is used by the instructor to identify and explain the function of all ejection seat components. He also uses it to explain the reason for going through the prescribed ejection procedure, to show how to assume correct body position prior to ejection, and the movements to make for correct ejection.

Cessody is also working on capsule trainers for other flight gear procedures.

### Fluorinated Oil Shows Jet Promise

New fluorine-containing synthetic lubricating oils, which are not decomposed by temperatures as high as 500°F, should find applications in aircraft jet turbines and new high-boost turbojet engine nozzles and gas turbines, a Navy document reports.

The synthetic fluids are said to equal petroleum oils in lubricating quality and are less susceptible to fire and explosion hazards, but their greater weight may be a drawback. Known as

derivatives of fluorobenzene, they withstand high temperatures because of the fluorine atom attached to the ends of the molecules.

Details of tests made by the Surface Chemistry Branch, Naval Research Laboratory, Washington, D. C., were recently given by Harold Kavanagh, a physical chemist at the laboratory, to the American Chemical Society in Cincinnati.

Reasons that gases based on the fluorine-containing atoms have been prepared, and experience shows they may be useful in such friction bearings operating at elevated temperatures.

## ROBINSON WIRE TWISTER now in 2 sizes!



New 9" Standtype for bench work in aircraft, shipboard, industrial and maintenance 12 in. weight 12" Standtype for assembly line safety work 15 in. weight

Light second wheeling safety safety wheel 3 in. weight in line assembly required for use. Starts at \$140 per machine assembled.

3-inches in-1 — Flare cutters — rebar cutters

Side cutting, oil tempered blade Permanent linear bearing, no adjustment.

Lean back on wire, don't slip off. Unobstructed money back guarantee.

Write for details including prices, technicals and list of more. RALPH C. ROBINSON CO., Box 456-523, North Haven, Conn., U.S.A.

## STRESS AND STRUCTURES ENGINEERS

Many challenging new stress and structures assignments in jet aircraft, guided missiles, and space vehicles are available at Northrop Aircraft. Our Engineers qualified will be placed on the most advanced and difficult assignments and too, will be supported by Northrop's world famous engineering facilities. Thus, each individual will be afforded opportunity to develop to the utmost when his talent is called.

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- save machining time
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Edgewater welded rings, rolled from solid steel blanks, are made in diameters from 5 inches to 180 inches, and weights up to 14,000 pounds. The cross-section drawings above show some of the shapes produced by the Edgewater rolling process. Simple or complex sections are accurately formed, eliminating machining operations, and reducing material costs.

Among the applications for which Edgewater Rolled Steel Rings are recommended are: turbine parts, shroud rings, compressor rings, spacer rings, parts for reciprocating engines.

WRITE for free booklet describing how Edgewater Rolled Steel Rings are made and showing some of the solid-sections produced by this process.



**EDGEWATER STEEL COMPANY**

PITTSBURGH 26, PA.

## AF Manual Outlines Equipment Design

Handbook of Instructions for USAF Ground Equipment Design prescribes requirements for equipment, size, materials, strength, photographic and recording, aircraft support, towing, cover, aerial delivery, ground base installation, meteorological, administrative, supply, transportation and personnel equipment.

Instructions manual was prepared for Air Research & Development Command by Butler & Butler, New York. Write: Commander, Wright Air Development Center, Wright-Patterson AFB, Ohio, attention: WCCB.

## OFF THE LINE

Charles Butler Associates is new name of the industrial design organization formerly known as Butler-Zimmerman, Inc. It has handled various design for TCA and Capital Airlines' Vickers Viscounts. Charles Butler heads the new firm. Address: 77 E. 57th St., New York, N. Y.

Acropac Corp., aircraft hose manufacturer, has acquired Marmon Products, Inc., maker of clamps, fire parts and valves, as a step in Acropac's program of expansion and diversification.



**Arctic Rubber House**

An structure of 24 solid rubber tubes provides sufficient structural strength so that the rubber shelter can withstand 100-lb/sq ft winds and also snow loads of 24 tons. For U. S. Air Force use on the Arctic to house 30 men and rubber plating and tracking gear, the rubber shelter weighs 7,500 lb. It was developed by R. F. Goodrich Co.'s Industrial Products Division, Akron, Ohio in cooperation with Resko Rubber Division, Baltimore, Md., and Rome Air Development Center, N. Y.

A MESSAGE TO ENGINEERS  
WHO SEEK NEW SCOPE FOR THEIR ABILITY

## "FAIL-SAFE" STRUCTURES DESIGN

The "fail-safe" approach has been applied to various fields of engineering.

However, because of technical difficulties it has been used only to a limited degree in aeronautical structural engineering.

In fact, it stands today as a new concept in aircraft structures, although a number of "fail-safe" principles are found in current Lockheed production aircraft.

Now, Lockheed's Structures Division is initiating an extensive series of studies on the application of "fail-safe" structures design to virtually all types of aircraft.

It is a major effort.

J. F. McBarry, Chief Structures Engineer, and E. H. Spaulding, Structures Division head, are directing the studies.

It is Lockheed's belief that engineers associated with this program will participate in some of the most significant advances yet achieved in aeronautical structural engineering.

The program's broad scope has created a number of new positions on all levels for engineers with structures training.

Engineers who wish to participate in research and development work on "fail-safe" structures are invited to write E. W. DeLaunay, Dept. S-3-4.

**LOCKHEED** AIRCRAFT CORPORATION

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## Laminated Plastics Resist Moisture

Resistance to moisture, particularly in humid climates, is a chief feature of these new laminating plastics available in sheet, tube or special forms and applicable to dielectric and precision driven.

- DAP impregnated canvas C-104 is economical, easily machined.
- Odex 0-104 shows little change in power factor and dielectric constant after water absorptive tests.
- Woven glass-cloth G-104 possesses the best electrical properties in the dry condition, but shows a lighter rate of change when subjected to moisture.

Odex 0-104 will also maintain temperatures of 235F, canvas, 275F and G-104, 300F.

Herbert Widdow, Synthene Corp., Dallas, Tex.

## New Survival Outlet

Air Sea Rescue and Survival Devices established by Best Aircraft Corp. Division will supply life vests, rafts, emergency kits, food and life, dress and related products. Nicholas V. Wetzel will head up the new division at 210 W. Blyden St., Newark, N. J.



## Convair Quits 340

Smaller for the Convair 340 is a single-engine retractable tailfin with engine, in-place, two shoulder openings that were mounted on the Convair Quits. California edition program (AWM May 21, p. 16, Mar. 28, p. 17) includes additional sound proofing in cabin. Other modifications will increase speed and allowable gross weight.

## "Instant Response" VICKERS HYDRAULIC MOTOR ... THE AIRCRAFT HANDY MAN



Vickers Constant Displacement Prime Type Hydraulic Motors are available in 16 sizes for 200 psi.

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### AIRFUEL REFUELING PUMP DRIVE



Fast Transfer Pump used by North American Co. for Boeing KC-135 Tanker. Powered by Vickers "Instant Response" Hydraulic Motor.

### CATEN SUPERCHARGING



Properly D-27 Drive Supercharger is driven by Vickers "Instant Response" Hydraulic Motor.

### HORIZONTAL STABILIZER ACTUATOR



Built for Convair 440 by Cleveland Pneumatic Tool Co. Powered by Vickers "Instant Response" Hydraulic Motor.

### ALTERNATOR GENERATOR DRIVE



Alternator Generator Drive for Convair T-28 used Vickers "Instant Response" Hydraulic Motor.

### TELESCOPING BOOM ACTUATOR



Powered by Vickers "Instant Response" Hydraulic Motor.

### AIR COMPRESSOR DRIVE



Built by Vickers Hydraulic & Compressor, Inc. and driven by Vickers "Instant Response" Hydraulic Motor.

## What Can It Do for You?

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These light-weight, compact, highly efficient hydraulic motors provide high power in a very small package. Their overall efficiency exceeds 92%... their volumetric efficiency exceeds 94%.

Operating characteristics are remarkable. These motors will stop from maximum speed in from 1/16 to 1/8 of a revolution... will accelerate from standstill to maximum speed in from 0.001 to 0.001 sec. (depending on size). They can be started indefinitely without damage.

Vickers Hydraulic Motors have many uses in aircraft... just a few of them are shown above. Whenever you need high torque, high efficiency and high horsepower-to-weight ratio... or when maintenance and positive control are required, these motors are your best choice. Write for Bulletin A-3000.

704

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



## MB designed the engine mounts for the CONVAIR XFY-1



**MB** Straight up or straight-away, the Convairster XFY-1 enjoys an equally high degree of freedom from vibration. Its engine is mounted on two types of mounting units designed by MB specialists. In any attitude of flight, these new MB 4941 and 4943 mounts do their job of absorbing power plant and propeller vibrations to protect the aircraft structure, instruments, and help reduce flight fatigue.

This is one more case where, right in the design stage, a major airplane manufacturer has relied on MB vibration engineering to ensure special problems.

15 years of performance records with MB mounts provide plenty of working proof that the aviation industry has placed the vibration control job in good hands.

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### Blower Checks Fire Control Unit

Portable blower that provides a 100-wpk vacuum has been devised by Norfleck Aircraft, Inc., designed for quick and accurate alignment and calibration of the attack sensor portion of the F-94D Scorpion's radar fire control system.

The portable "windtunnel" reduced about into a 25 x 4 in. electric fan. Air flow is directed over the sensor's angle of attack deflection probe. The unit is being shipped to all USAF bases where F-94Ds are stationed.

Norfleck Aircraft, Inc., Hawthorne, Calif.



### USAF Gets Equipment Centrifuge

A large rotary centrifuge capable of testing two pieces of equipment weighing 100 lb. and the use of 30 in. radius has been built for the USAF Test Center at Edwards AFB, Calif.

Upper range of Model E-185 is 60G, with a capacity of 34,800 G's at each of the two platforms. Automatic dynamic balancing shifts the composite center of gravity of opposing centrifugal forces into the same rotating plane, the manufacturer says.

Power requirement is 74 hp from 0 to 360 acceleration takes about 15 sec., 0-60 takes about 45 sec.

General, Inc., 2335 Federal Ave., Los Angeles 64, Calif.

### Test Stand Has High Flow Rate

A hydraulic test stand that can deliver fluid at pressures up to 5,000 psi and flow rates of 50 gpm. has been developed by Giner Hydraulic, Inc. This is

second timing pip system, and a control unit that can be located remotely.

The instrument consists of various components of the transducer on plunger and can be adapted to test any physical phenomena that can be translated into linear motion.

Rockwell & Wirtley, Inc., 906 E. San Carlos Ave., San Carlos, Calif.

### Unit Shows, Corrects Unbalance

Dynamometer of high-speed rotation can be measured to better than 0.00041 in. or, by qualified personnel, the maker of a new machine reports.

Rotor is mounted in a jig in front of the machine. It is brought to the desired speed, automatically controlled within 2 rpm. An electric spark marks the point of unbalance. Plans of unbalance and amount of corrective drill are indicated visually.

Also connected with the machine is a high-speed precision drill, to drill corrective holes.

Dodson Aviation Corp., 1561 Franklin Ave., Philadelphia 25, Pa.



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NEW CAPITAL AIRLINES VISCOUNT powered by Rolls-Royce "V" is shown earlier by ROBINSON.

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**A NEW CONCEPT IN FLIGHT.** Viscount is one of the most advanced transport planes to be put into commercial service in the United States, providing practically non-stop flights at 30,000 feet. It is powered by four Rolls-Royce propeller turbine engines for a cruising speed of 335 miles per hour and a top speed of 335 m.p.h.

**A NEW CONCEPT IN VIBRATION CONTROL.** Robinson all-steel, specially engineered vibration and shock absorbing mounting systems protect Viscount's valuable electronic equipment against vibration. This, while imperceptible to passengers, may damage the delicate components of electronic equipment. Another benefit of effective vibration control is longer service life.

As aircraft engineers know, an electronic measuring system should have a high percentage of critical damping during resonance. The Met-L-Pac engine is critical of Robinson Engineered Systems afford from 15 to 30% damping, at least 5 times that of standard rubber mounts. Their performance is unaffected by grease, oil, water, dust, extreme temperatures or environmental changes.

Allow us to advise you on the protection and installation of airborne electronic systems. We believe you will be interested in free Bulletin No. 900, entitled "Robinson Vibration and Shock Mounts for Guided Missiles, Rockets and Jet Aircraft." Address: Airborne Division.

WFO Case  
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double the flow rate available in previous linear models of this type.

Multiple mount models permit the technician to test several components simultaneously.

The model KG-900 also has a 20,000 psi hand pump for static and proof pressure testing, an air pressure vessel to test air systems equipment, and an electrical circuit to check out dielectric components. Precision instruments show flow rate and pressure.

Power is supplied by a 75 hp electric motor.

Coast Hydraulics, Inc., New York International Airport, Jamaica 16, N. Y.



### Dome Houses Tracking Gear

Service crews making time for dial testing precision instruments used in tracking guided missiles will watch action of the enclosed equipment even during high-speed close-range operation.

A novel oil seal between dome and base structure affords positive sealing from against weather and wind, the manufacturer states. Dome is constructed of fiber glass. Servo drive is tied to the tracking instrument, which controls the dome, so precision ball bearings on a 9/16-in. cylindrical base structure. Drive is effected by a pulley and belt gear.

Elk Electronic, Oakham Tool & Armory Corp. of America, Asheville, N. C.



### New Telemetering Oscillator

New and advanced a new field telemetering oscillator will provide accurate measurements of speed, pressure, altitude, air pressure perturbations on aircraft surfaces and other data on planes or missiles, according to the manufacturer.

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## Mass Produces complex structural fittings



Kuders day aircraft require lighter, stronger structures to cope with the higher loads encountered at speeds above Mach 1. The elimination of a single structural joint will often contribute a savings of many pounds in a highly loaded member. The result has been the trend to larger and more complex single structural fittings. Loud has made over 10,000 leading gear trussone fittings which is an excellent example of mass producing a tough job while maintaining a high degree of quality.

### CASE HISTORIES

Today's airplane is being built out of large forgings rather than fabricated sections. The spar fitting which combines leading gear trussone support and wing spar into one single forged and machined fitting is representative of planes of tomorrow. Although this fitting is over 8 feet long it is machined on Loud's 130 inch Cincinnati hydraulic lathe. Advances in design create more complicated machined operations.

The maximum utilization of facilities is illustrated in the final welding of a stabilizer beam. The change from the previous built-up joint design saved over 16 pounds per airplane in addition to saving considerable cost and providing a stronger fitting.

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Dutton Engineering Corp., 6382 W. 94th St., Los Angeles 45, Calif.

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New D-6518A unit weighs 10 oz. and measures 3 1/2 in. It has a self-folding cord and detachable base. List price is \$14.75.

Gruen Manufacturing Co., Urbana, Ohio, available at 501 Associated branches.

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Three external meter and frequency standard for high-speed electrical or mechanical devices display time directly to the nearest 0.0001 sec. The meter reports. Two ranges, of one and 10 sec., are provided. W-210 meter mount, as an electronic counter, can count 90,000 pulses/sec. For use as a frequency standard, 1 hr and 20 hr. (one) pulse outputs are provided. Price \$394, to 5—Wentzel Electric, El Segundo, Calif.

Double-end centrifugal blower weighs 12 oz., measures 3 1/2 in. x 2 1/2 in. and delivers about 50 cfm at 60 in. Type 5012-203 unit is designed for 274-in. d.c. compressor and normally drives approximately 1 imp.—Dutton Manufacturing Co., Los Angeles, Calif.

Seviatec uses plastic materials, with cell structure like wood, but having ends reinforced denser and stronger, are applicable for structural aircraft wings and similar structures. Material is produced by bonding autotransformer fusible phenolic spheres with fusible polymers, phenolic or epoxy resins—Seviatec Co., 268 Madison Ave., New York 16, N.Y.

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## False Economy

A critical blow has been struck at the foundation of American aerospace by the House Appropriations Subcommittee on Independent Offices headed by Albert Thomas of Texas. This subcommittee has recommended to the House an \$8.8 billion cut in the fiscal 1976 budget of the National Advisory Committee for Aeronautics. On the surface this appears to be an insignificant amount particularly when compared with the \$20 billion requested for procurement and operation of military aircraft and guided missiles.

Yet this \$8.8 million cut in the NACA budget may have a disastrous effect on the quality and scientific effectiveness of the \$20 billion worth of aerospace Congress is willing to buy without question. The basic research and development activities of NACA are the foundation on which virtually all of the aircraft and missile development in the western world rests. NACA does little work on nuclear weapon development but its research and development is involved with every type of delivery system now under consideration to put these weapons on enemy targets.

It is no secret that development of atomic and hydrogen weapons has far outstripped the development of efficient delivery systems. Obviously our present superiority in nuclear weapons will be of little avail without a corresponding superiority in delivery methods. Every responsible top-level official concerned with development of military aerospace in this country has warned that we are in the midst of a fierce technological race with Russia for supremacy in nuclear weapons and delivery systems.

In this race, NACA occupies a key position of support for the technological, military and industrial effort that translates its data into consistently superior aerospace. During preparation of the fiscal 1976 budget Dr. Jerome C. Hunsaker and Hugh L. Dryden, chairman and director respectively, of NACA, made a personal presentation to President Eisenhower at the White House, as the critical need for accelerated research effort to meet the pace of this international technological competition.

Despite his deep desire to cut federal expenditures and balance the budget, President Eisenhower authorized a 10% increase in the NACA research budget. The President's decision was based on his recognition of the critical position of our aeronautical research effort.

This 10% increase in the NACA research effort has been woped out by the House committee. It means that accelerated effort in the critical fields of stability and control, aircraft and missile structures, supersonic and transonic drag, rocket fuels and nuclear propulsion will have to be abandoned. All of this costs \$5.8 million.

This year the aircraft and missile industry will be making their first use of the Utahian plan supersonic wind tunnels built on NACA facilities and scheduled to be operated by NACA personnel. Congress and the Defense Department placed high priority on the Utahian plan's facilities as a vital tool for accelerating aircraft and missile development.

The \$1.6 million slash from the Utahian tunnel opens twice budget will mean less research time for critical military projects, longer hours required for data reduction and a general slow-down on this high priority project. Another \$1.3 million has been cut from proposed construction of new research facilities. This 30% slash in the \$15 million fiscal request will have an effect far beyond that envisioned by the committee that recommended the cut. It is impossible to cut 30% from a wind tunnel. If sufficient money is not available for the entire project, it must be dropped from the schedule.

Perhaps one of the basic faults underlying the action of the House committee is that NACA has been extremely reluctant to publicize its accomplishments or share credit when they are translated into events of national importance. For example, few people outside the aircraft industry today know the story of the NACA-developed laminar flow wing that made it possible for the North American P-51 Mustang to escort bombers all the way to Berlin during World War II. Many people even in the aircraft industry today are not aware of another NACA discovery that has had a profound effect on improved performance of all new USAF and Navy supersonic fighters. Without the research spent on NACA's fundamental research and development work, the billions later spent on aircraft and missile procurement could easily be wasted on inferior equipment.

We currently urge congressmen and senators who will give final judgment on the scale of NACA's research effort for the future to consider the few millions required to do this job adequately. Votating the billions for procurement without the vital millions for research and development is false economy of a disastrous brand.

## The Langley Gold Medal

The Langley Gold Medal awarded by the Smithsonian Institution is one of America's oldest and highest honors. Since Wilson and Orville Wright received the first Langley medal in 1909 it has been awarded on only five other occasions.

The presentation to Dr. Hunsaker was made at a private reception and dinner in the Great Hall of the Smithsonian by the Honorable Warren, Chief Justice of the United States, acting in his capacity as Chancellor of the Smithsonian's board of regents.

The citation accompanying the medal as read by Justice Warren said the award to Dr. Hunsaker was "in recognition of your unique and superlative important contributions to aeronautics as a distinguished designer of aircraft, as the center of a great center for instruction in aeronautical engineering, and as the scientific genius under whose leadership the preeminent National Advisory Committee for Aeronautics has become the world's greatest scientific aeronautics research organization."

It is a fitting reward for a lifetime of contributions to accelerated development that almost spans the history of powered flight.

—Robert Holt

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